Saskatchewan
Environment

Hydrology Branch

Qu'Appelle River Basin
1982 Spring Runoff

February, 1984
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CHAPTER I

DESCRIPTION OF THE QU'APPELLE RIVER BASIN

A. TOPOGRAPHIC FEATURES

The Qu'Appelle River basin encompasses an area of about 51 800 square kilometres of southern Saskatchewan. Runoff from the basin flows into the Assinboine River near St. Lazare, Manitoba, and eventually reaches Hudson Bay via Lake Winnipeg and the Nelson River. The drainage boundary of the Qu'Appelle basin is delineated on Figure 1.

Flat to undulating topography predominates. Glacial depressions and sloughs abound on the uplands. Typical of the runoff from these areas is the overflow of water from slough to slough until the flow, by way of small creeks and gullies, eventualy reaches the main channel.

A prominent topographical feature of the Qu'Appelle River basin is the occurrence of deep tributary valleys up to 45 metres deep and 915 metres wide. Outstanding examples are the valleys of Moose Jaw and Arm Rivers and Wascana, Ekapo, Kaposvar, Pheasant, Squaw, Echo, Jumping Deer, Indian Head and Cutarm Creeks.

The Qu'Appelle Valley ranges in width from 0.8 to 2.5 kilometres. Total depth varies from 30 to 90 metres. The

maximum elevation of the valley floor is 535 metres at a locality appropriately named the "Summit", now the site of the Qu'Appelle River Dam. The valley floor is at elevation 404 m at the Saskatchewan-Manitoba border.

There are eight lakes along the mainstem of the Qu'Appelle River. From west to east these lakes are Eyebrow, Buffalo Pound, Pasqua, Echo, Mission, Katepwa, Crooked and Round. Manmade control structures maintain all lakes at optimum levels for recreation, water supply, wildlife, and flood control. Last Mountain Lake lies north of the Qu'Appelle River but affects the river flows because of its connection through Last Mountain Creek.

The Qu'Appelle River is a mature river with a broad flat plain and freely developed meanders. The river channel has a low gradient and its capacity varies markedly through its length.

B. CLIMATE

The Qu'Appelle River basin has a continental climate which is characterized by extreme variability of temperature and low water vapour content of the air. Geographically, the basin is near the centre of the North American continent. It seldom experiences the modifying influence of either the Gulf of Mexico or Hudson Bay air masses. To the west, the Rocky Mountains form an effective barrier to the transport of Pacific Ocean moisture.

Hot and dry summer weather generally prevails throughout the Qu'Appelle River basin. Extreme temperatures of up to 45°C have been recorded. Winter weather can be severe with frequent raging blizzards and low visibility. Minimum temperatures of -45°C are not uncommon. Prolonged cold weather may continue for one month or more.

Average annual precipitation ranges from 355 mm to about 432 mm. Recorded annual precipitation has been as low as 17.8 mm causing severe drought.

Winter precipitation averages about 100 mm. Above normal autumnal precipitation, high winter precipitation, low winter snow pack losses and rapid snowmelt may combine to cause spring floods.

C. HISTORIC FLOODING

Most floods that have occurred in the Qu'Appelle basin have been largely a consequence of above normal fall and winter precipitation, low winter snow peak losses and a rapid rate of warm-up during the spring months. Lake levels prior to runoff, precipitation during runoff, and the relative timing of tributary peak flows also influence the magnitude of flood. Major floods have been recorded in 1904, 1916, 1922, 1927, 1948, 1955, 1969, 1970, 1974 and 1976. Highest recorded flows have not always occurred at the same time in the upper

and lower portions of the Qu'Appelle. In the reach above the Fishing Lakes the record peak flow (436 m^3/s at Lumsden) occurred in 197 , while the record peak flow (241 m^3/s at Tantallon) in the lower Qu'Appelle occurred in 1955. Average peak flows at Lumsden are 28 m^3/s while average peak flows at Tantallon are 26 m^3/s.

CHAPTER II

DATA COLLECTION NETWORKS

A. HYDROMETRIC NETWORK

Runoff is that part of precipitation that appears in surface streams. The control, conservation and use of runoff for irrigation, recreation, flood control, municipal and industrial projects in the Qu'Appelle River basin directly affects approximately 20 per cent of the Saskatchewan population.

In order to plan for optimum water use to satisfy present and future requirements in the basin it becomes imperative to study the potential of the basin by using historical data.

To provide meaningful information under flood conditions it is necessary to have a comprehensive knowledge of runoff conditions in all parts of the basin during the flood event.

To provide sufficient data upon which to conduct runoff studies it is necessary to have a hydrometric data gathering network in the basin. Such a network is composed of an orderly layout of hydrometric stations throughout the basin. Continuous records of river or lake levels are maintained at each of these stations. At the hydrometric stations located

on the rivers or streams, a systematic flow measurement plan is implemented to establish and maintain stage-discharge relationships. This provides the tool for translating the stage records to rate of flow records and thus a measurement of the flow volume which passes any given station.

The Water Survey of Canada (WSC) Environment Canada is responsible for most of the hydrometric data collection in the Qu'Appelle. Saskatchewan Environment and Saskatchewan Agriculture, Conservation and Development Branch also collect miscellaneous records which are used as a supplement to the WSC records for special purposes or studies. The location of provincial and federal hydrometric network stations are shown on Figure 1.

B. METEOROLOGICAL NETWORK

The Atmospheric Environment Service of Environment Canada maintains a climatological network in the Qu'Appelle River basin. Table 1 lists the stations from this network which are used by Saskatchewan Environment in the planning for management of water throughout the Qu'Appelle River basin.

C. SNOW SURVEYS

Snow survey measurements are generally conducted during the latter part of the winter period at the locations shown on

Figure 2 (1982 results shown in Table 2). The purpose of these measurements is to determine the water equivalent of the snow remaining on the ground at the time of the survey.

Table 1

QU'APPELLE RIVER BASIN CLIMATOLOGICAL STATIONS
1981-82 PRECIPITATION

Location	August-October		November-February	
	Recorded / Normal	Percent Normal	Recorded / Normal	Percent Normal
Davidson	128.5 / 96.3	133%	47 / 66	71%
Tugaske	133.9 / 102.9	130%	63.5 / 75.2	84%
Moose Jaw	123.4 / 97.4	127%	67.4 / 71.4	94%
Dilke	113.8 / 103.3	110%	57.6 / 71.7	80%
Watrous	110.2 / 106.2	104%	31.3 / 67.1	47%
Nokomis	104.9 / 112.5	93%	19 / 76.7	25%
Strasbourg	146.6 / 113.4	129%	53.7 / 69.6	77%
Caron	130.4 / 94.7	138%	93.1 / 85.6	109%
Yellowgrass	112.6 / 104.6	108%	64.9 / 50.3	129%
Regina	153.9 / 105.2	146%	63.1 / 69.6	91%
Kelliher	165.0 / 123.4	134%	66.5 / 76.8	87%
Lipton	154.6 / 104.6	148%	83.6 / 80.5	104%
Balcarres	173.4 / 96.3	118%	49.2 / 89.1	55%
Indian Head	134.8 / 116.1	116%	87.0 / 81.8	106%

Table 2

1982 SNOW SURVEY RESULTS IN QU'APPELLE RIVER BASIN

Snow Course	Mid-Feb 1982		Mid-March 1982		Normal	
	Snow Depth (cm)	Water Equiv (mm)	Snow Depth (cm)	Water Equiv (mm)	Snow Depth (cm)	Water Equiv (mm)
LAST MOUNTAIN LAKE BASIN						
DELLWOOD BROOK EAST	14.8	24.1	10.2	24.1	19.0	38.6
DELLWOOD BROOK WEST	14.7	24.1	14.8	26.7	24.6	50.9
DUVAL	12.0	27.3	9.0	24.6	12.7	35.6
LOCKWOOD	9.2	17.6	13.0	25.4	22.6	54.7
PENZANCE A-13	25.8	59.0	50.0	110.2	16.5	38.4
ST. GREGOR	7.2	7.2	11.2	26.2	18.4	38.4
WATROUS A-14	6.7	15.6	1.5	11.1	15.9	36.0
ZELMA	16.6	25.0	12.2	31.8	22.5	57.8
UPPER QU'APPELLE RIVER BASIN						
BRIDGEFORD NORTH	30.5	34.6	26.7	57.5	21.8	58.5
BRIDGEFORD SOUTH	2.7	17.3	0	0	8.2	21.3
CRAIK	13.5	30.9	12.7	39.6	15.7	43.0
EYEBROW	34.5	51.9	29.7	86.0	13.5	37.4
SQUAW CREEK NORTH	22.0	34.6	18.5	56.3	22.7	56.0
TUGASKE	13.8	30.9	10.8	31.7	13.6	43.7
TUGASKE BRIDGE	16.9	25.3	12.7	37.7	15.0	38.9
LOWER QU'APPELLE RIVER BASIN						
ABERNETHY	19.0	31.0	9.6	22.0	14.6	31.7
BIRMINGHAM	22.8	41.0	10.3	4.0	18.5	40.3
DUFF	8.7	26.0	1.0	1.0	16.8	41.8
ESTERHAZY	24.7	36.0	8.8	11.0	20.7	41.0
GRENFELL	19.0	35.0	12.0	22.0	18.5	37.8
JEDBURGH SOUTH	14.0	26.0	8.8	9.0	19.3	40.2
LIPTON	26.1	45.0	24.8	44.0	23.2	45.6
WILLOWBROOK	22.8	40.0	13.3	16.0	21.8	44.8
WILLOWBROOK S.W.	19.8	28.0	8.5	10.0	19.4	41.2

CHAPTER III

STREAMFLOW FORECASTING

Peak flow and water supply (March-May runoff) forecast equations have been developed for most of the major tributaries using multiple linear regression based on fall antecedent (August to October) and winter (November to March) precipitation. Using these forecasts, average recession curves and median dates of peak, spring runoff hydrographs are constructed. These hydrographs are then used in the SSARR[1]/ model to forecast Qu'Appelle mainstem peak flows and lake levels. During the spring runoff event forecasts are continually updated; recorded flows are projected downstream. These forecasts are particularly useful in planning the operation of the various control structures along the Qu'Appelle system.

1/ SSARR - Streamflow Synthesis and Reservoir Regulation, U.S. Corps of Engineers.

CHAPTER IV

ACTIVITIES PRIOR TO SPRING RUNOFF

On February 1, 1982, a forecast was issued outlining in general the spring runoff potential. On March 1, 1982, a more detailed forecast was issued and at the same time, urban centres and R.M.'s were advised to take necessary precautionary measures of dyke maintenance and clearance of debris from bridges and culverts. Rural residents were also warned to move machinery, grain, structures and livestock from flood endangered areas. Detailed forecasts were again issued on March 15, April 1, 1982, and during the runoff as required to keep the public informed of expected flows.

CHAPTER V

GENERAL CONDITIONS PRIOR TO AND DURING SPRING RUNOFF

Following the drought conditions during the spring and summer of 1981 the Qu'Appelle basin experienced a fairly wet fall (125 to 150 per cent of normal precipitation during the August-October period) and slightly below normal winter precipitation (70-90 per cent of normal November-February period). Based on these indicators the initial forecast was for a normal to slightly above normal runoff. This "normal" forecast pointed towards favourable runoff conditions in the Qu'Appelle River basin; the lakes were expected to fill and peaks would be below levels at which damages occur. Although some flooding of agricultural lands was expected there was no threat of flooding in urban centres.

On March 1, 1982, forecasts, based on the regression equations (Table 3), were input to the SSARR model. In light of the drought conditions experienced in 1981, providing for greater storage potential and infiltration, computed flows were considered to be too high; issued forecasts (Tables 4 to 6) were adjusted downward to reflect these factors. The forecast runoff potential varied from above normal (1:4 to 1:6 event) for the reach above the Fishing Lakes to normal (1:2 event) in the Lower Qu'Appelle. The Moose Jaw River and Wascana Creek basins with snowpack water equivalents of 150 per cent of normal were expected to produce near bank full flows.

Above normal precipitation (200 percent of normal) occurred during the first half of March and continued cold weather maintained the snowpack intact, increasing the potential for higher runoff flows. The mid-March forecast indicated that peak flows in the Moose Jaw River and Wascana Creek basins would approach bank full capacity (1:10 event), thereby increasing the potential for flooding of agricultural lands in the Qu'Appelle Valley between Buffalo Pound and Pasqua Lakes, but posing no threat to urban centres. Forecasts for the Lower Qu'Appelle remained at near normal levels except for a slight increase in the forecast for Indian Head Creek.

During the second half of March more snowfall to the south of the Trans-Canada Highway significantly increased the runoff potential for the Moose Jaw River, Wascana Creek and the Qu'Appelle River in the reach between Buffalo Pound and Pasqua Lakes. As a consequence, April 1 forecasted flows and lake levels were increased over March 15 forecasts to reflect these conditions.

A brief warming trend in late March significantly ripened the snowpack before a return to colder weather in early April. This was followed by a sudden and continued rise in temperatures to the 10^{o}-15^{o}C range that resulted in some minor flooding in the urban centres and major flooding of agricultural lands above Pasqua Lake. Flows in tributaries to the south of the Qu'Appelle Valley, between Katepwa and Crooked Lakes were well above normal while

Table 3

1982 SPRING RUNOFF FORECASTS BASED ON PRECIPITATION EQUATIONS

Tributary	X_1	March 1			March 15			April 1		
		X_2	Flow	Vol.	X_2	Flow	Vol.	X_2	Flow	Vol.
Qu'Appelle River above Buffalo Pound Lake	128.6	69.8	18.4	11.7	72.8	19.5	12.5	85.8	26.7	17.4
Arm River near Bethune	121.2	66.7	7.7	6.9	71.1	9.7	8.0	74.1	11.0	8.7
Jumping Deer Creek near Lipton	159.8	94.9	3.9	2.0	94.2	4.9	2.6	105.5	4.5	2.7
Indian Head Creek near Indian Head	134.8	105.7	13.0	4.6	104.4	11.5	4.45	107.8	13.5	4.8
Pheasant Creek near Abernethy	137.7	82.7	9.2	6.6	85.8	10.0	7.0	90.9	11.0	7.7
Kaposvar Creek near Esterhazy	216.0	60.0	10.0	9.9	65.0	10.0	9.9	52.1	10.0	9.3
Boggy Creek near Lumsden	153.9	63.0	4.9	4.3	76.7	10.0	6.2	92.2	16.0	9.5

1. X_1 = Fall antecedent precipitation in mm
2. X_2 = Winter precipitation in mm
3. Forecast Flow (Q) in m^3/s
4. Forecast Volume (V) in $m^3 \times 10^6$

Q or $V = AX_1 + BX_2 + C$

where,

A, B & C = constants

tributaries to the north had below normal flows. Tributary flows east of Crooked Lake were also below normal. A detailed summary of spring runoff conditions by reach is given in Chapter VI.

Table 4

1982 SPRING RUNOFF FORECASTS FOR QU'APPELLE RIVER TRIBUTARIES

Hydrometric Station Name	Historical		Forecast Peak 1/			1982 Recorded	
	Yr	Peak	Mar 1	Mar 15	Apr 1	Peak	Date
Ridge Creek near Bridgeford	74	33.1				22.5	Apr 14
Squaw Creek near Craik	74	21.1				8.6	Apr 14
Moose Jaw River near Burdick	74	368	60 (60)	80 (91)	110 (118)	154	Apr 19
* Arm River near Bethune	74	86.7	7 (7.7)	8 (9.7)	10 (11)	29.7	Apr 17
* Wascana Creek near Lumsden	74	153	30 (47)	50 (56)	60 (67)	99.9	Apr 19
Boggy Creek near Lumsden	75	56.6	5 (4.9)	10 (10)	16 (16)	26.2	Apr 16
*Jumping Deer Creek near Lipton	43	14.1	3 (3.9)	4 (4.9)	4 (4.5)	3.8	Apr 13
Echo Creek near Fort Qu'Appelle	75	34.0	12.5	12.7	12.7	25	Apr 15
*Indian Head Creek near Indian Head	76	31.7	10 (13)	10 (11.5)	14 (13.5)	34.7	Apr 14
*Pheasant Creek near Abernethy	76	47.3	10 (9.2)	10 (10)	11 (11)	10.3	Apr 13
Ekapo Creek near Marieval	76	44.7	14.2	14.2	14.2	9.7	Apr 15
Kaposvar Creek mouth	55	17.0	10 (10)	10 (10)	10 (10)	3.4	Apr 12
Cutarm Creek near Spy Hill	55	25.6	12.4	12.5	4.0	3.1	Apr 16

1/ Peak Mean Daily Flow in m^3/s

* Station having issued forecasts

( ) Flows computed by Regression Equations.

Table 5

1982 SPRING RUNOFF FORECASTS FOR QU'APPELLE RIVER MAINSTEM LOCATIONS

Qu'Appelle River Mainstem Location	Historical		Forecast Peak [1]			Recorded	
	Yr	Peak	Mar 1	Mar 15	Apr 1	Peak	Date
Above Buffalo Pound Lake	74	107	15	15	20	75.6	Apr 14
Below Moose Jaw River	74	278	70	90	120	111	Apr 20
* Lumsden	74	436	75 (87)	100 (103)	120 (138)	210	Apr 21
Below Craven Control	74	141	(40)	(49.6)	(67.1)	62.1	Apr 22
Below Loon Creek	74	162	(28.9)	(43.3)	(66.5)	50.9	Apr 27
Outlet Katepwa Lake	74	79.9	(16.8)	(25.0)	(35.1)	33.6	May 10
Hyde	76	206	(42.5)	(44.5)	(51.3)	96.8	Apr 17
* Tantallon	55	240	25 (26.2)	25 (28.6)	30 (35.4)	--	--
Welby	55	251	(37.1)	(37.7)	(35.7)	32.6	May 4

1 Peak Mean Daily Flow in m^3/s

* Stations having issued Forecasts

( ) Flows computed by SSARR model

Table 6

1982 SPRING RUNOFF FORECASTS FOR QU'APPELLE VALLEY LAKES

Lake	Pre-Runoff	Approx. Shoreline Level	Normal Summer Level	Recorded High		March 1		March 15		April 1		1982 Recorded Peak Level
				Level	Year	*Most Likely	Possible ** High	*Most Likely	Possible ** High	*Most Likely	Possible ** High	
Buffalo Pound	509.3	509.9	509.3	511.4	1974	509.7	509.9	509.7	509.9	509.8	509.9	510.68
Last Mountain	489.6	490.7	490.1	492.1	1955	490.2 (490.0)	490.5	490.3 (490.1)	490.5	490.4 (490.3)	490.6	490.77
Echo, Pasqua	478.6	479.4	479.0	480.7	1974	479.1 (479.1)	479.3	479.2 (479.3)	479.4	479.4 (479.6)	479.6	479.63
Katepwa, Mission	478.3	478.8	478.2	479.5	1974	478.5 (478.5)	478.6	478.6 (478.6)	478.7	478.7 (478.7)	478.8	478.60
Crooked	450.9	452.3	451.7	454.4	1955	451.8 (452.0)	452.1	451.9 (452.0)	452.1	452.1 (452.1)	452.3	452.38
Round	441.5	443.2	442.3	445.3	1955	442.5 (442.6)	442.8	442.5 (442.7)	442.8	442.7 (443.0)	443.0	442.83

NOTES:
1. All levels in metres above mean sea level.
2. There is a 50 per cent chance that the "most likely level" will be exceeded.
3. There is a 10 per cent chance that the "possible high level" will be exceeded.

* Any flood hazard measures which economically minimize the damage potential at this level should be implemented.

** Any flood hazard measures which economically minimize the damage potential at this level should be scheduled for emergency action.

() Levels computed by SSARR.

CHAPTER VI

DETAILED SUMMARY OF SPRING RUNOFF CONDITIONS BY REACH

A. UPPER QU'APPELLE

The normal winter releases of 1.4 m^3/s and 0.7 m^3/s from the Qu'Appelle River dam and the Buffalo Pound control, respectively, were terminated on March 19 in preparation for spring runoff.

Spring runoff in the Upper Qu'Appelle commenced near April 10. Tributary flows rose rapidly with Ridge Creek peaking at 22.5m^3/s on April 14 (1:25 event). These tributary flows resulted in a peak inflow to Buffalo Pound Lake of 75.6 m^3/s (1:18 event) on April 14. These flows flooded most of the valley bottom lands between Ridge Creek and Buffalo Pound Lake. North of Keeler and Marquis two roads went under water. Tributary flows receded rapidly (Ridge Creek was down to 2 m^3/s by April 19) and resulted in flows on the mainstem dropping to 5 m^3/s by April 22. As a result of dyke washouts, both above and along Eyebrow Lake, flows in this reach of the river rose to 11.4 m^3/s on April 25 but then drained rapidly. Flows fell to 2 m^3/s by May 1 and then receded to the less than 0.3 m^3/s by May 9. Flows then fluctuated in the 0.2 to 0.3 m^3/s range until late May.

Buffalo Pound Lake rose rapidly from a pre-runoff elevation of 509.24 m on April 5 to 510.5 m on April 20; then rose more gradually to peak at 510.7 m on April 29.

Inflow to Buffalo Pound Lake from the Moose Jaw River occurred, first for a brief period in mid-April as a result of an ice jam on the Qu'Appelle River in the area below the confluence, then again as peak flows of 154 m^3/s on the Moose Jaw River reached the Qu'Appelle on April 19. The inflows in each case were relatively small.

To reduce water levels on Buffalo Pound Lake, one row of logs were removed from the structure on April 30 raising outflows to 5 m^3/s and lake levels began receding. On May 5, more logs were removed, increasing flows to 15 m^3/s and again on May 7 releases were increased to 30 m^3/s. As a result, Buffalo Pound Lake levels dropped to 510.46 m by May 7 then dropped rapidly to 510.09 m by May 13 at which time releases from the lake were terminated. Levels slowly receded to 510.06 m near the end of May at which time, as a result of rain storms, levels rose to 510.14 m and the structure was opened to release 1 m^3/s. Releases were increased to 2 m^3/s on June 7 and lake levels receded to 510.1 m by mid-June.

B. LUMSDEN AREA

Peak flows on the Moose Jaw River of 130 m^3/s above the City of Moose Jaw (154 m^3/s at Burdick a 1:18 event) on April 19

and on Wascana Creek of 62 m^3/s through the City of Regina (99.9 m^3/s at the mouth a 1:25 event) on April 21 resulted in some minor flooding of low lying lands in both Moose Jaw and Regina. These flows, along with high flows on other tributaries (Cottonwood Creek peaked at 47 m^3/s on April 17), resulted in a peak flow on the Qu'Appelle River at Lumsden of 210 m^3/s (1:40 event) on April 21, the second highest flow on record (436 m^3/s recorded in 1974) and caused major flooding of agricultural lands in the valley between Buffalo Pound Lake and Lumsden.

Improvements to the dykes surrounding the Nicolle wildlife management area prevented flooding of the area and was in part responsible for the flow of Moose Jaw River water into Buffalo Pound Lake and perhaps a slight increase in downstream flows.

Flows in the Moose Jaw River were less then 10 m^3/s in early May when the 30 m^3/s release was made from Buffalo Pound Lake. This release, therefore, did not cause any more flooding but did delay the drainage of some of the flooded lands between Buffalo Pound Lake and Lumsden by a few days.

A more detailed account of the runoff in the Moose Jaw River Basin is contained in Appendix A.

After the April 21 peak at Regina, the inflow to Wascana Lake had dropped off enough to allow replacement of stoplogs in the

Albert Street structure on April 27 and the closure of gates on May 7. By mid-May flows in Wascana Creek at the mouth were less than 3 m^3/s.

A more detailed account of runoff in the Wascana Creek Basin is contained in Appendix B.

Flows on the mainstem Qu'Appelle at Lumsden rapidly receded to 100 m^3/s by May 1, to near 40 m^3/s by May 12 and to less then 5 m^3/s in late May, only to jump up to 15 m^3/s on June 1 following rain storms (50-75 mm) in Moose Jaw River and Wascana Creek basins.

C. CRAVEN AREA

In preparation for spring runoff flows, all logs were removed from the Valeport control on March 25, thus allowing for a split of runoff flows.

With peak flows of 210 m^3/s on April 21 past Lumsden, combined with tributary flow (Boggy Creek 23 m^3/s on April 17), extensive areas of agricultural land in the valley from Craven to Pasqua Lake were flooded. At Craven, there was a split of flows (70 percent of flow to Last Mountain Lake and 30 percent downstream of Craven) resulting in a peak flow of approximately 160 m^3/s into Last Mountain Lake and 60 m^3/s downstream of Craven. This inflow combined with other

tributary flow (Arm River - 30 m^3/s on April 17) raised Last Mountain Lake levels from 489.67 m in early April to 490.6 m by May 5.

By mid-May most of the upstream flow (15 m^3/s) was passing Craven with only a slight inflow to Last Mountain Lake. Some draining of Valeport Flats was occurring. In an effort to drain flooded agricultural lands between Craven and Pasqua Lake the Qu'Appelle Operation Board decided to close the Craven Control and divert the remaining spring flows into Last Mountain Lake. This operation was justified on the basis that it would only have minimal effects on Last Mountain Lake levels, but would be most beneficial in draining flooded lands downstream.

Between May 16 & 18 the Craven control was logged to 490.7 m and the gates closed, reducing flows to a leakage of 0.8 m^3/s. Last Mountain Lake rose to 490.7 m by June 1 and continued to rise as a result of rain storms. Peak elevation for the year on Last Mountain Lake was 490.77 m on June 23.

D. FISHING LAKES

The Echo Lake structure had been fully open since the end of October, 1981.

1. Echo Lake

Echo Lake levels had dropped to 478.70 m on April 12 just prior to runoff. Runoff from local tributaries (Loon Creek) produced an initial inflow to the lakes of 16 m^3/s on April 15. Inflows receded to 9 m^3/s on April 18, but then began rising with the arrival of upstream flows which peaked at 51 m^3/s on April 27. Lake levels rose swiftly to 478.9 m by April 20, then more slowly to 479.0 m by April 25. As upstream flows arrived, levels again rose rapidly to 479.4 m by April 30 and peaking at 479.63 m on May 7. Upstream flows receded rapidly to 20 m^3/s by mid-May and to less than 10 m^3/s by the end of May following closure of the Craven control. In response, lake levels steadily dropped and were back within the operating range by June 3.

2. Katepwa Lake

The new Katepwa Lake control was not operated prior to or during spring runoff. Katepwa Lake at a level of 478.29 m just prior to runoff, rose rapidly as local tributary flow (Echo Creek peaked at 25 m^3/s April 15) produced an initial peak of 478.52 m on April 19. Levels then dipped to 478.44 m by April 25 and began rising again as upstream flows reached the lake. Lake levels peaked at 478.60 m on May 10 with an outflow of 33.6 m^3/s. Levels then slowly receded to 478.52 m by the end of May with an outflow of 23 m^3/s.

E. LOWER QU'APPELLE

1. Crooked Lake

With the structure wide open since the end of October, 1981, lake levels dropped to 450.8 m by April 1. Local tributary flow, especially from the south side of the valley (Indian Head Creek peaked at 34.7 m^3/s on April 14, a 1:15 event), produced a peak inflow to Crooked Lake of 96.8 m^3/s (at Hyde) on April 17 raising lake levels to an initial peak of 452.38 m on April 22. There was very little inflow from tributaries along the north side of the valley (Pheasant Creek peaked at only 10 m^3/s April 13, a 1:2 event). Inflows fell rapidly to a low of 18 m^3/s on April 30 causing lake levels to recede to a low of 451.75 m on May 8. Then as upstream flows rose to a second peak of 32 m^3/s on May 15, lake levels rose to peak at 451.96 m May 26. Inflows dropped to 25 m^3/s in early June and lake levels receded to the upper limit of the desirable operating range by June 11.

2. Round Lake

With the structure wide open since the end of October, 1981, lake levels dropped to 441.4 m by late March. Local inflow raised lake levels to an initial peak of 442.83 m on April 28. Inflows dropped off and lake levels receded to a low of 442.52 m on May 12. As

upstream flows reached the area lake levels rose to a second peak of 442.64 on May 27.

3. Below Round Lake

Runoff below Round Lake was very low (Kaposvar Creek peaked at 3.5 m^3/s on April 12 and Cutarm Creek peaked at 2.0 m^3/s April 20) with an initial peak of 42 m^3/s on April 16 at the Qu'Appelle River near Welby hydrometric station. Flows then receded to the 12 m^3/s range, rose to a second peak at 32.6 m^3/s on May 6 following the first peak on Round Lake, then slowly receded to 26 m^3/s on May 16 and remained stable until the end of May. Flows continued to recede as Round Lake levels dropped and the structure was closed on June 14.

CHAPTER VII

FLOOD DAMAGES

A. UPPER QU'APPELLE

Most of the land between Ridge Creek and Buffalo Pound Lake was flooded during the early stages of runoff but drainage was rapid and little damage occurred to the land.

Two grid roads in the Qu'Appelle Valley were under water and closed to traffic for a brief period: (1) the grid road north of Keeler experienced only minor erosion, with grading repairing most of the damage; and (2) the grid road north of Marquis experienced major erosion to the south of the bridge crossing the Qu'Appelle River. There were also numerous washouts of culverts on the many small tributaries.

Dyke washouts along the Qu'Appelle River were experienced at a number of locations: (1) just upstream (left bank) of Eyebrow Bridge; (2) right bank halfway between Eyebrow Control and Eyebrow Bridge; (3) three washouts along dyke along downstream end of Eyebrow Lake; (4) overflow section in right dyke just below Tugaske Bridge; (5) left bank just upstream Tugaske Bridge; (6) right bank just upstream Co-op Bridge; and (7) left bank halfway between Co-op Bridge and Elbow drop structure, required extensive repairs.

Buffalo Pound Lake rose to 1 metre above maximum desirable levels and remained as much as 0.4 m high into mid-June. These high water levels caused considerable erosion and slumping of banks at numerous points along the lake shoreline.

B. BUFFALO POUND LAKE TO CRAVEN

Most of land in this reach was flooded but drain in time to produce a crop. The Valeport Flats Northwest 22-20-21-2 did not drain in time to produce a hay crop.

The grid road just below the confluence of Moose Jaw and Qu'Appelle Rivers washed out and required extensive repairs. There was minor erosion of banks along the Lumsden floodway.

On April 17 ice and high water flows washed out the bridge on #20 Highway over Last Mountain Creek Diversion canal, 1 km south of Craven. The bridge was not replaced until early May. High water levels on Last Mountain Lake caused serious shoreline erosion.

C. CRAVEN TO PASQUA LAKE

Most of the valley bottom land in this reach was flooded leaving roads across the valley under water and impassible [along East boundary 28-20-20-2 (steel br.); North boundary 34-20-20-2 (Starkeys Bridge); East boundary 27-21-20-2 (Zedies)].

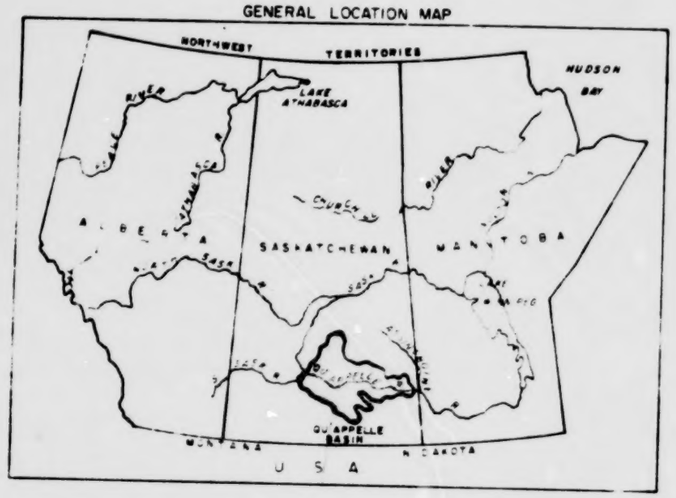
Lands upstream of 27-21-20-2 (1.5 km east of No. 6 Highway) drained in time to produce a good hay crop as did the lands below Loon Creek, except for the area just above Pasqua Lake. Lands from east of 27-21-20-2 to the east end of the Piapot Indian Reserve did not drain in time to produce a hay crop. There were numerous bank washouts, especially between Starkeys and No. 6 Highway and from Edenwold Bridge to Pasqua Lake.

D. LOWER QU'APPELLE

The lower Qu'Appelle experienced a normal spring runoff that drained rapidly and did not result in flood damages.

FIGURES

GENERAL LOCATION MAP



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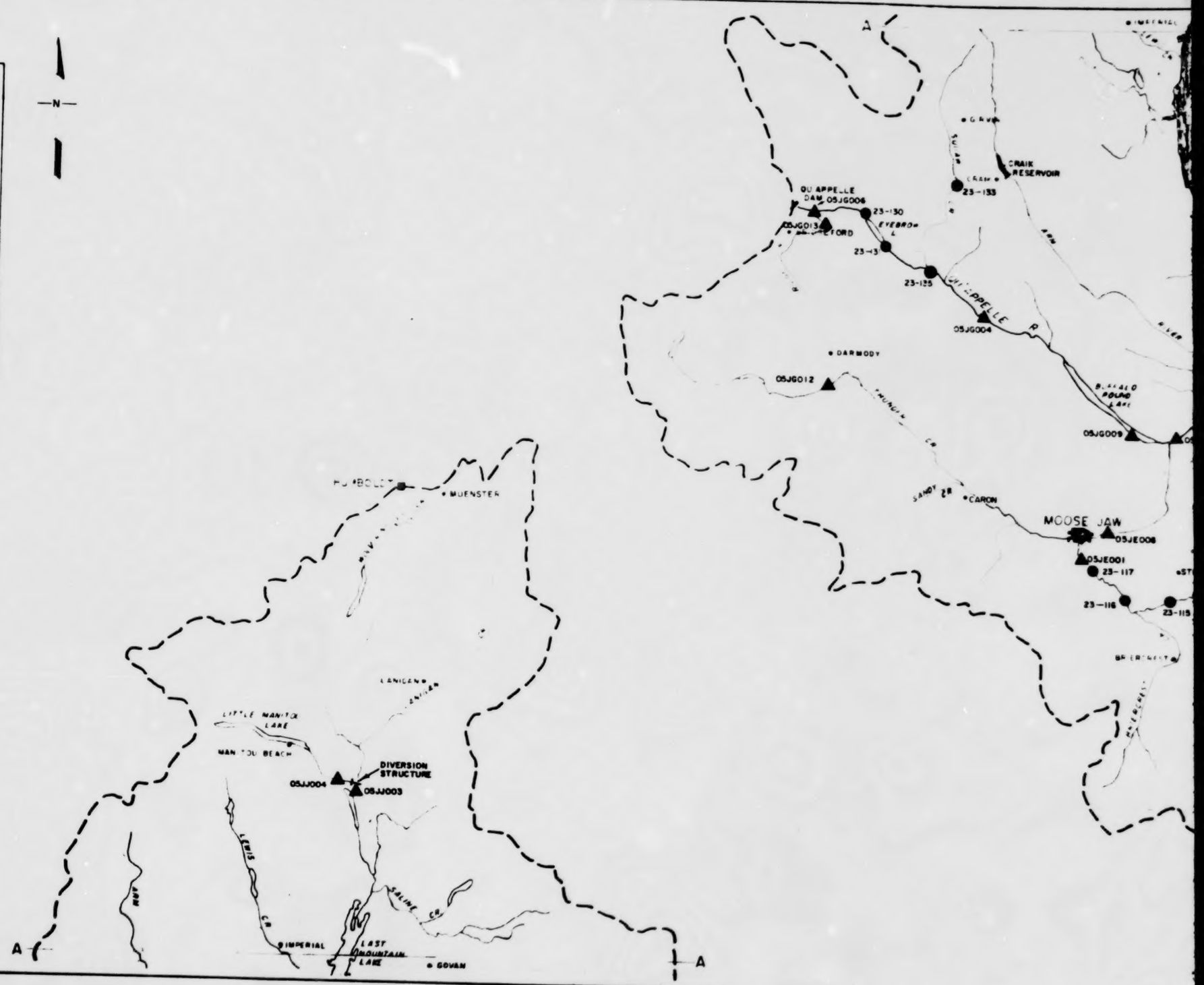
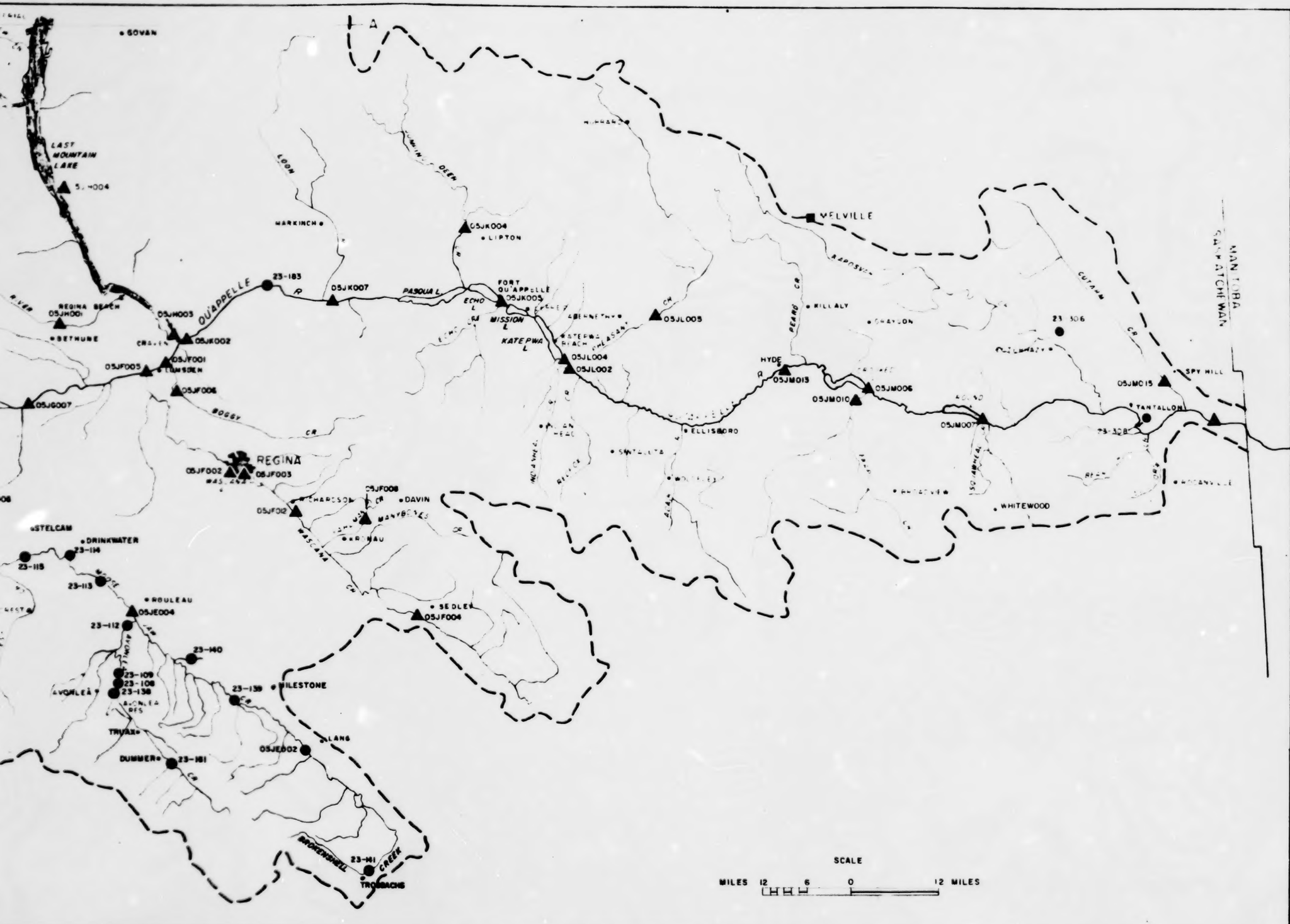




WATER SURVEY OF CANADA GAUGING STATIONS

STATION NO ▲	LOCATION
05JG006	Qu'Appelle River below Qu'Appelle Dam
05JG004	Qu'Appelle River above Buffalo Pound Lake
05JG009	Buffalo Pound Lake at pumping station
05JG007	Qu'Appelle River below Moose Jaw River
05JF001	Qu'Appelle River at Lumsden
05JK002	Qu'Appelle River below Craven Dam
05JK007	Qu'Appelle River below Loon Creek
05JK005	Echo Lake near Fort Qu'Appelle
05JL004	Katepwa Lake at outlet weir
05JM013	Qu'Appelle River at Hyde
05JM006	Crooked Lake near Crystal
05JM007	Round Lake near Whitewood
05JE004	Moose Jaw River near Rouleau
05JE001	Moose Jaw River above Thunder Creek
05JE006	Moose Jaw River above junction of Qu'Appelle R.
05JF004	Wascana Creek near Sedley
05JF012	Wascana Creek Below Kronau Marsh
05JF002	Wascana Lake at Regina
05JF003	Wascana Lake at Regina
05JF005	Wascana Creek above junction of Qu'Appelle R
05JF008	Fishman Creek near Davin
05JF006	Boggy Creek above junction of Qu'Appelle River
05JH003	Last Mountain Creek near Valeport
05JH004	Last Mountain Lake at Rowans Ravine
05JH001	Arm River near Bethune
05JK004	Jumping Deer Creek near Lipton.
05JL002	Indian Head Creek near Indian Head
05JL005	Pheasant Creek near Abernethy
05JM010	Esapo Creek at Manevo.
05JE002	Moose Jaw River near Lang
05JM015	Gutarm Creek near Spy Hill
05JG012	Thunder Creek near Darmody
05JJ003	Lanigan Creek below diversion
05JJ004	Lanigan Creek diversion to Little Manitou Lake
05JG013	Ridge Creek near Bridgeford

PROVINCIAL GAUGING STATIONS

STATION NO. ●	LOCATION
23-108	Avonlea Creek on Avonlea Grid
23-109	Avonlea Creek 2 miles North of Avonlea Grid
23-112	Avonlea Creek near Rouleau
23-113	Moose Jaw River near Pitman
23-114	Moose Jaw River near Drinkwater
23-115	Moose Jaw River near Stelcam
23-116	Moose Jaw River near Tilney
23-117	Moose Jaw River at 5.0 mile Dam
23-130	Qu'Appelle River above Eyebrow Lake
23-131	Qu'Appelle River below Eyebrow Lake
23-135	Qu'Appelle River below Squaw Creek
23-133	Squaw Creek near Craik
23-138	Avonlea Reservoir near Avonlea
23-139	Moose Jaw River near Milestone
23-140	Wilcox Main Ditch near Wilcox
23-141	Brokenshell Creek near Trossachs
23-161	Avonlea Creek east of Dummer.
23-308	Qu'Appelle River at Tantallon.
23-306	Kaposvar Creek at old Hwy #22

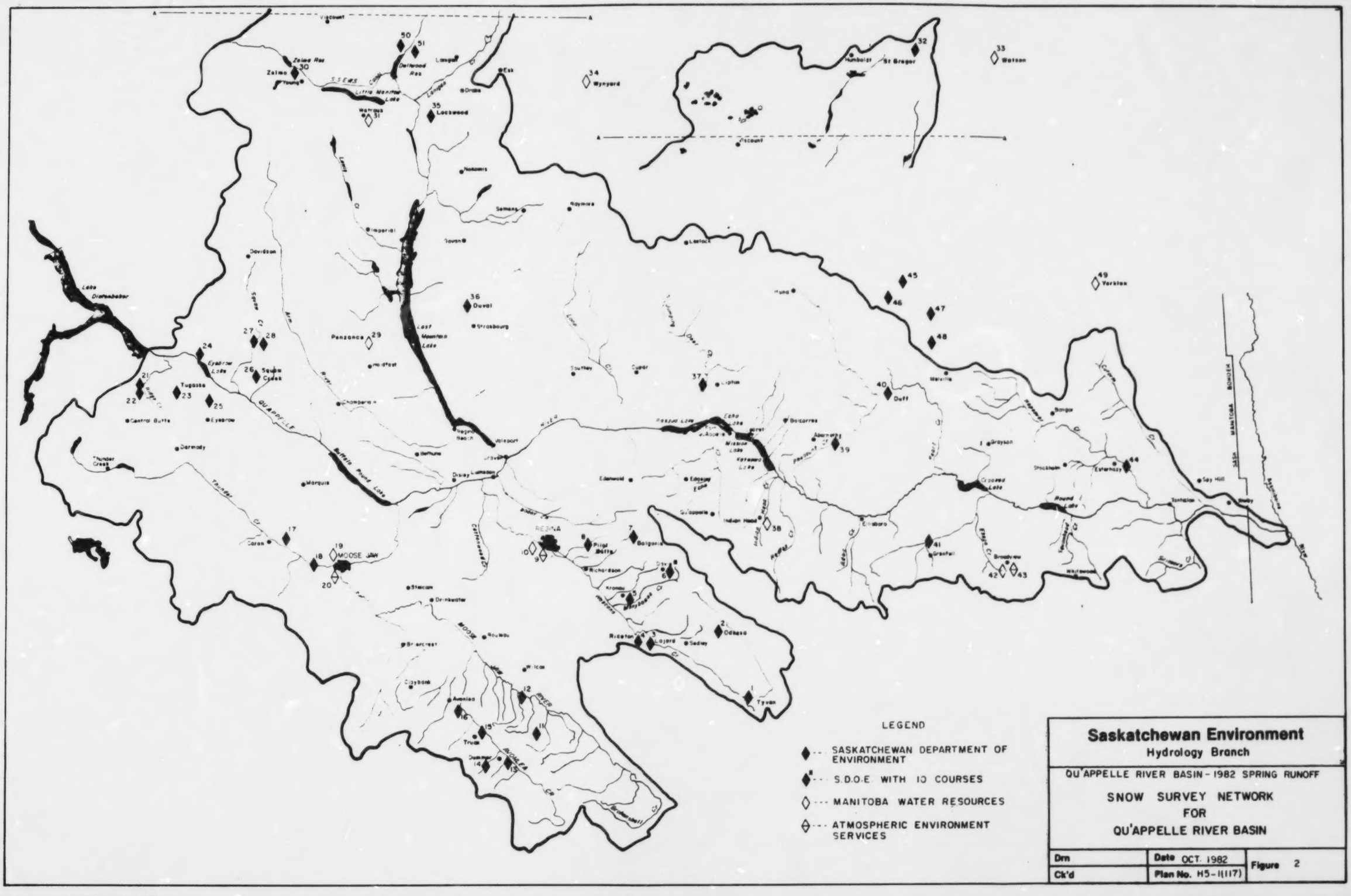
Saskatchewan Environment

Hydrology Branch

QU'APPELLE RIVER BASIN
1982 SPRING RUNOFF

KEY MAP OF QU'APPELLE BASIN
SHOWING GAUGING STATIONS

Drn J W W	Date OCT 1982	Figure 1
Ck'd	Plan No. H5-1(116)	


Viscount
Zelma Res
Zelma
Young
Little Manitou Lake
Watrous
Delwood Res
Langham
Dinsdale
Lockwood
Naicam
Semans
Imperial
Davidson
Penzance
Duval
Strasbourg
Lost Mountain Lake
Chamberlain
Wynyard
Humboldt
St Gregor
Watson
Lanigan
Leroy
Lake Diefenbaker
Eyebrow Lake
Tugaske
Squaw Creek
Central Butte
Eyebrow
Qu'Appelle River
Buffalo Pound Lake
Thunder Creek
Dermody
Marquis
Caron
Moose Jaw
Pilot Butte
Balgonie
Regina Beach
Valeport
Lumsden
Edenwold
Indian Head
Qu'Appelle
Ellisboro
Grenfell
Broadview
Wolseley
Whitewood
Stockholm
Esterhazy
Grayson
Langenburg
Borgie
Melville
Lestock
Punnichy
Kelliher
Southey
Cupar
Lipton
Balcarres
Abernethy
Duff
Yorkton
Zenon Park
Tisdale
Kamsack
Canora
Sturgis
Norquay
Sandy Hill
Manitoba
Saskatchewan
Assiniboine River
Moosomin
Broadview
Kronau
Odessa
Lajord
Sedley
Riceton
Tyvan
Briercrest
Gravelbourg
Moose Mountain Creek
Avonlea
Truax
Dunmore
Ogema
Wilcox
Claybank
Rouleau
Stanley Reservoir
Qu'Appelle River
Big Muddy Creek
Wascana Creek
Pasqua Lake
Echo Lake
Mission Lake
Katepwa Lake
Round Lake
Crooked Lake
Last Mountain Lake
Lake Diefenbaker
Thunder Creek
Caron
Moose Jaw
Regina
Pilot Butte
Balgonie
Indian Head
Grenfell
Broadview
Wolseley
Whitewood
Esterhazy
Stockholm
Grayson
Yorkton
Melville
Lestock
Punnichy
Kelliher
Southey
Cupar
Lipton
Balcarres
Abernethy
Duff
Watson
Wynyard
Humboldt
St Gregor
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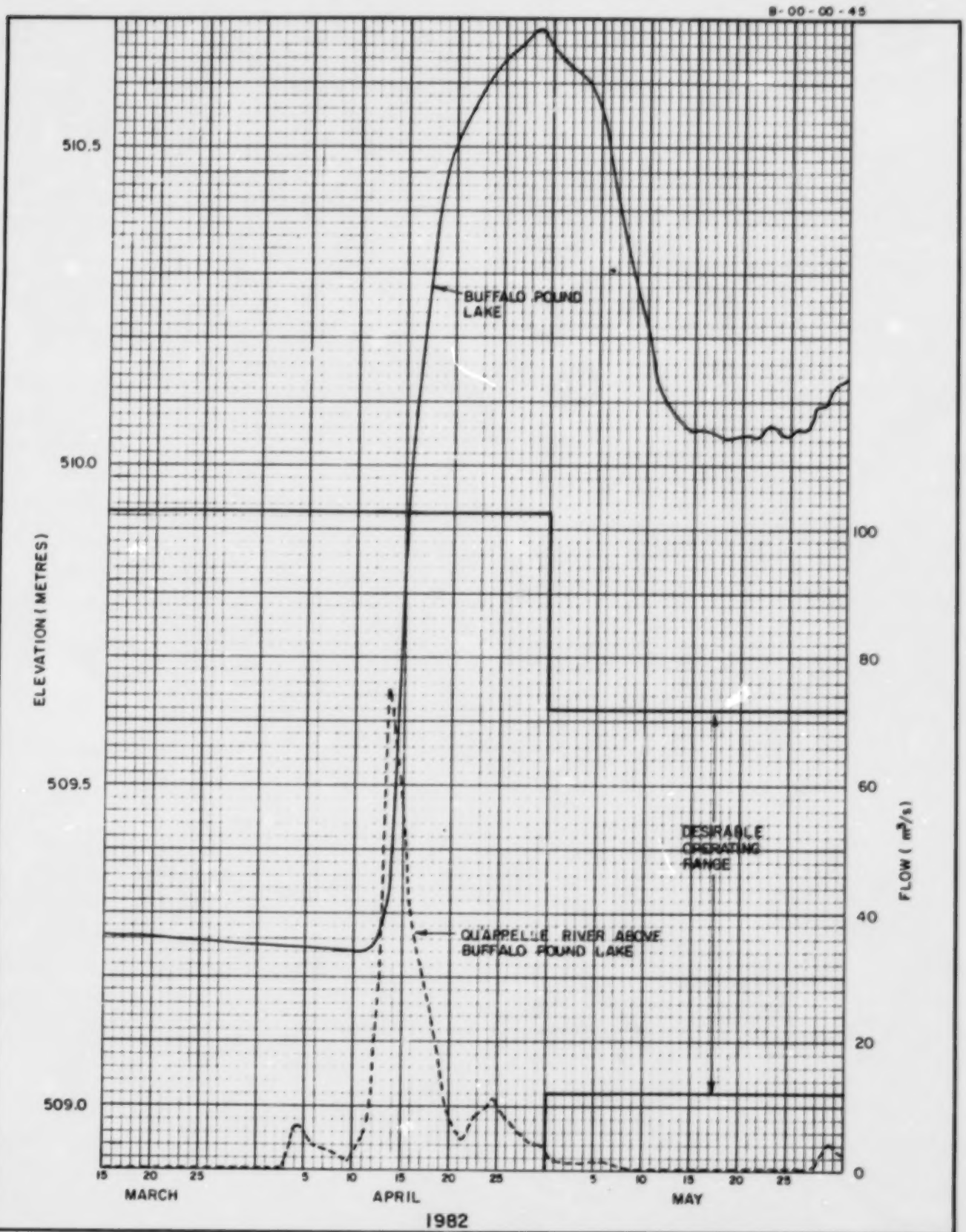
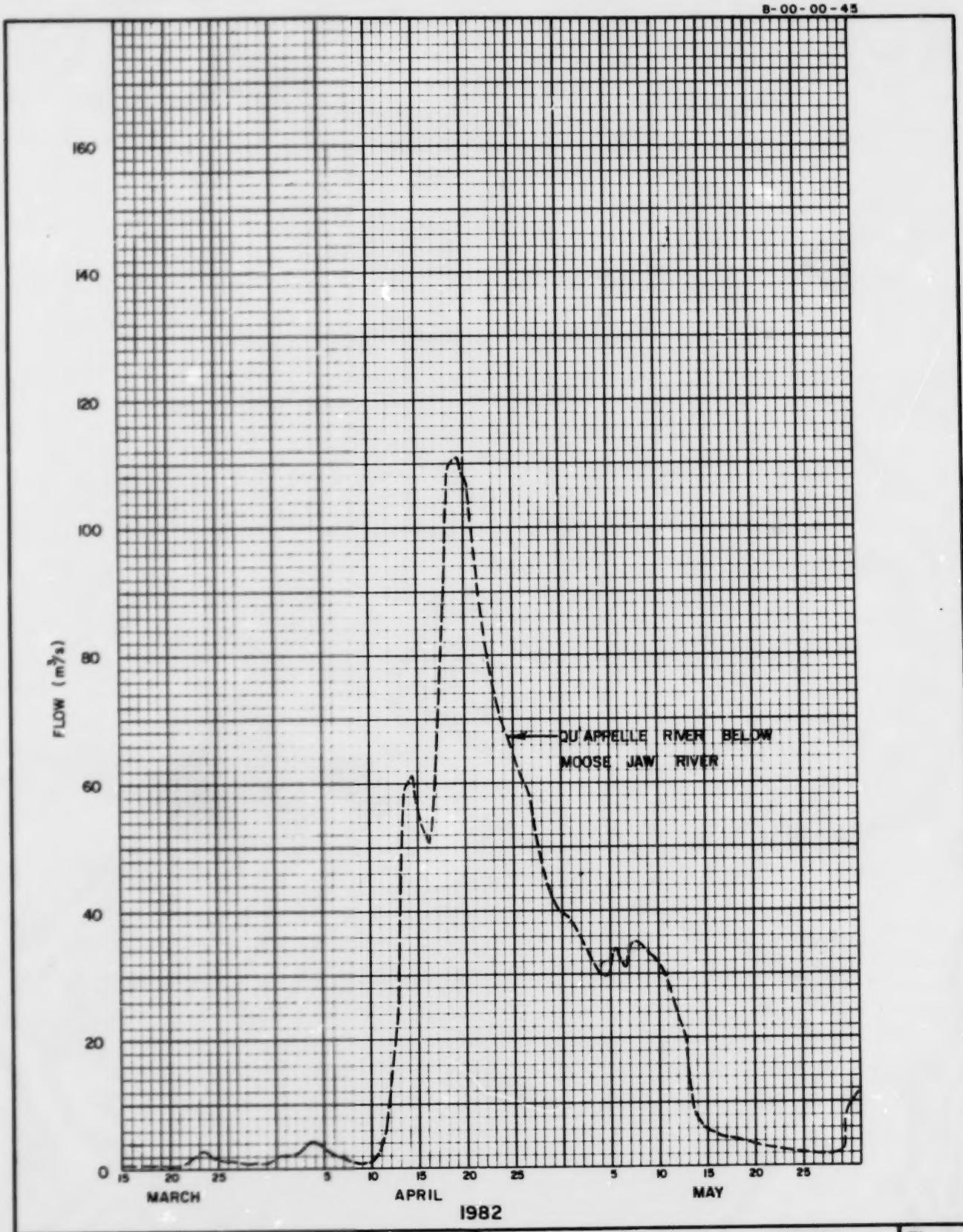
Naicam
Semans
Imperial
Davidson
Penzance
Duval
Strasbourg
Lost Mountain Lake
Chamberlain



Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN - 1982 SPRING RUNOFF BUFFALO POUND LAKE	Figure 3
Drn. J.B.	Date NOV. / 82		
Ck'd.	Plan No. H5-1 (118)		



Saskatchewan Environment Hydrology Branch	QU'APPELLE RIVER BASIN - 1982 SPRING RUNOFF BELOW BUFFALO POUND LAKE	Figure 4
Drn. J.B. / Date NOV./82		
Ck'd / Plan No. H5-1(119)		

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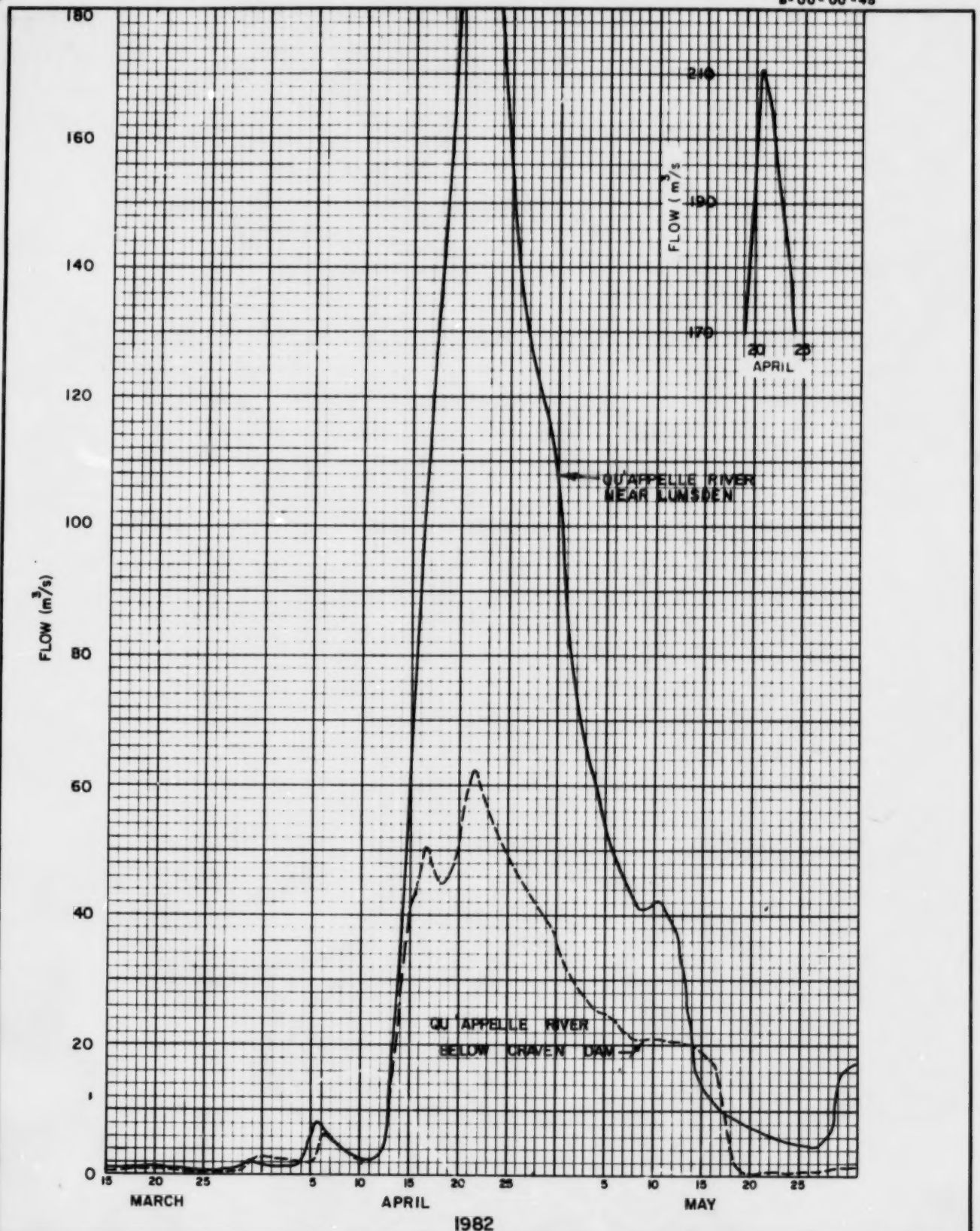

Saskatchewan Environment Hydrology Branch		QU' APPELLE RIVER BASIN - 1982 SPRING RUNOFF LUMSDEN-CRAVEN	Figure 5
Drn. J.B.	Date NOV./82		
Ck'd.	Plan No. H5-1(120)		

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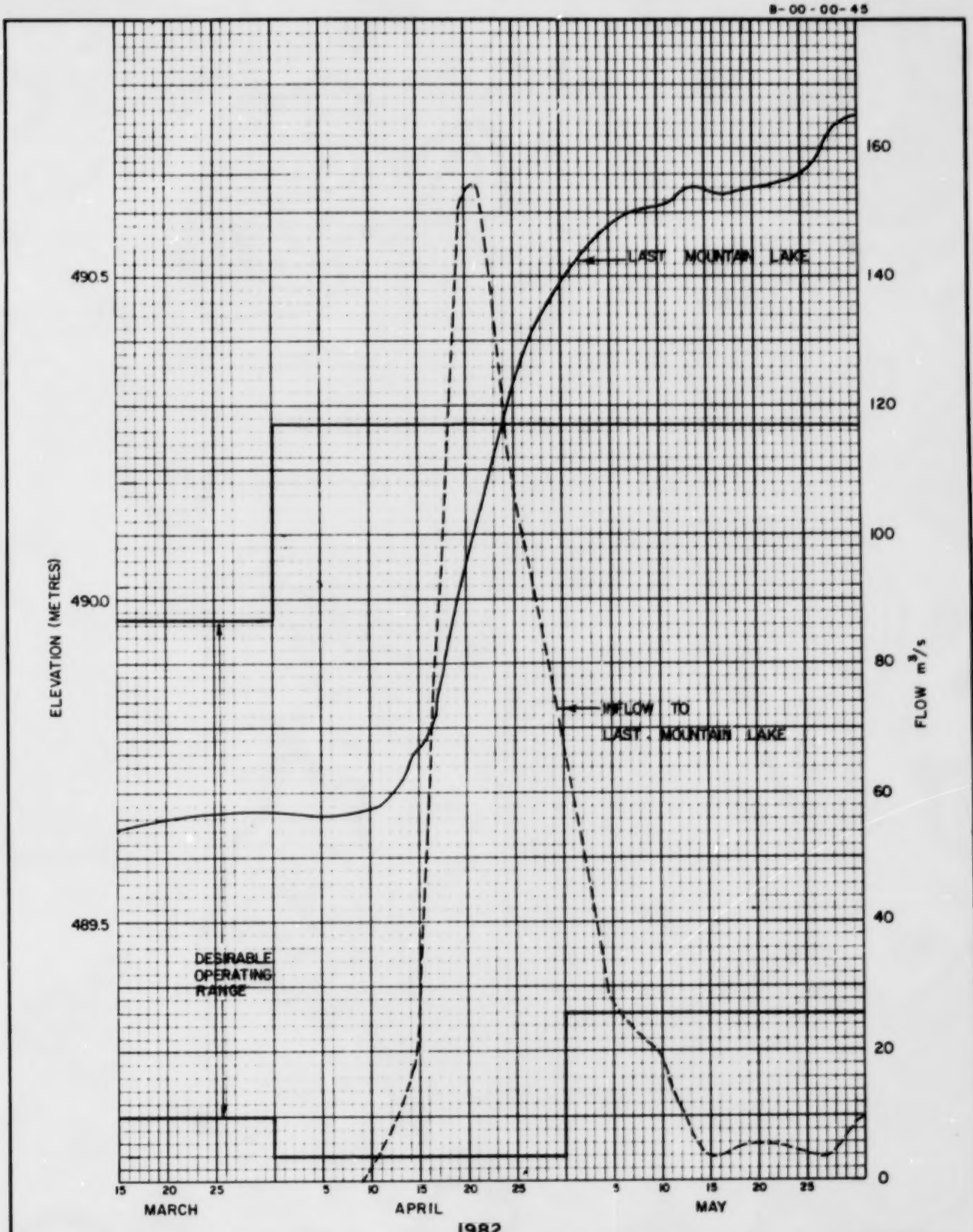
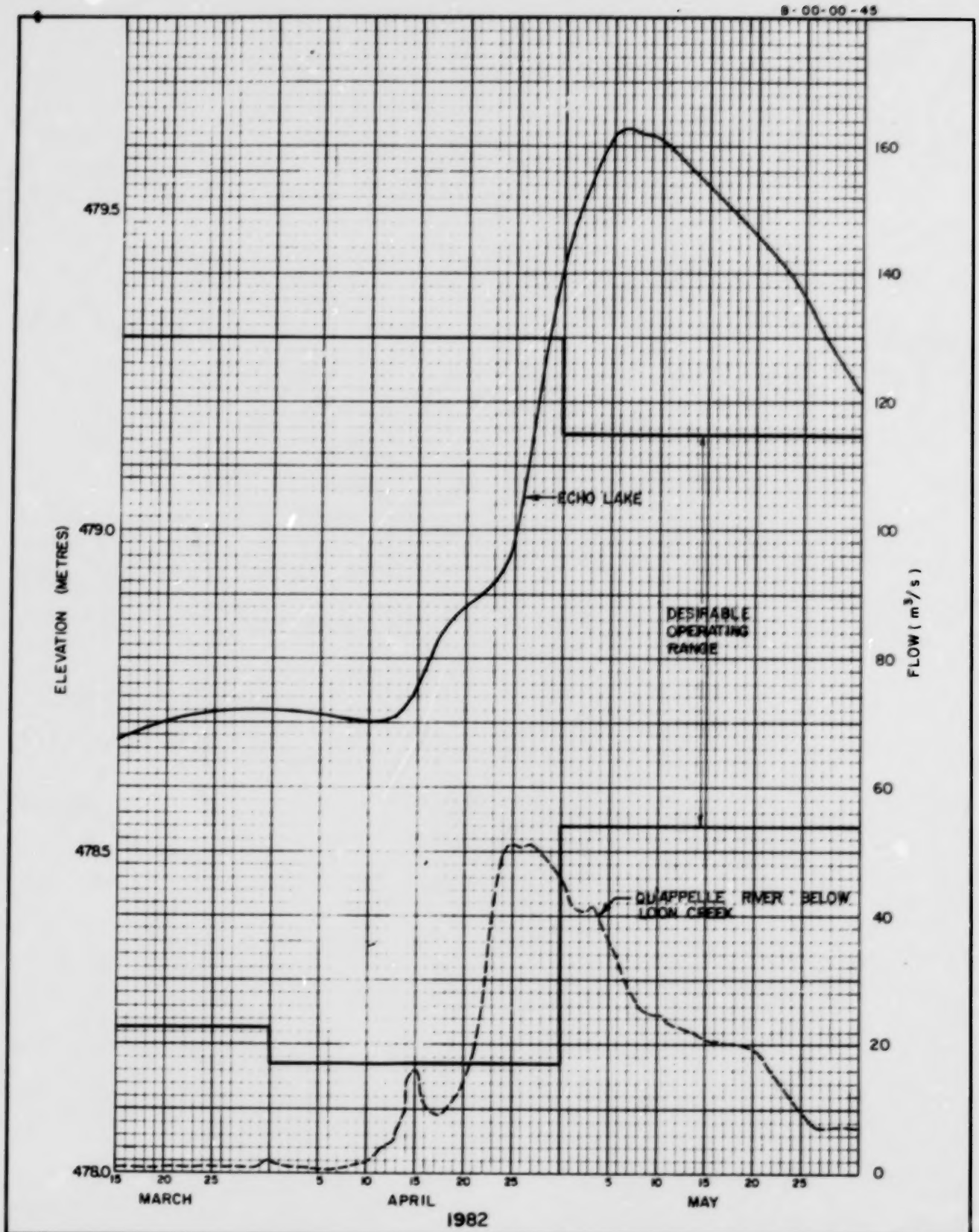


Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN- 1982 SPRING RUNOFF LAST MOUNTAIN LAKE	Figure 6
Drn. J.B.	Date NOV./82		
Ck'd.	Plan No. H5-1(121)		



Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN - 1982 SPRING RUNOFF ECHO LAKE	Figure 7
Drn. J.B.	Date NOV./82		
Ck'd.	Plan No. H5-1(122)		

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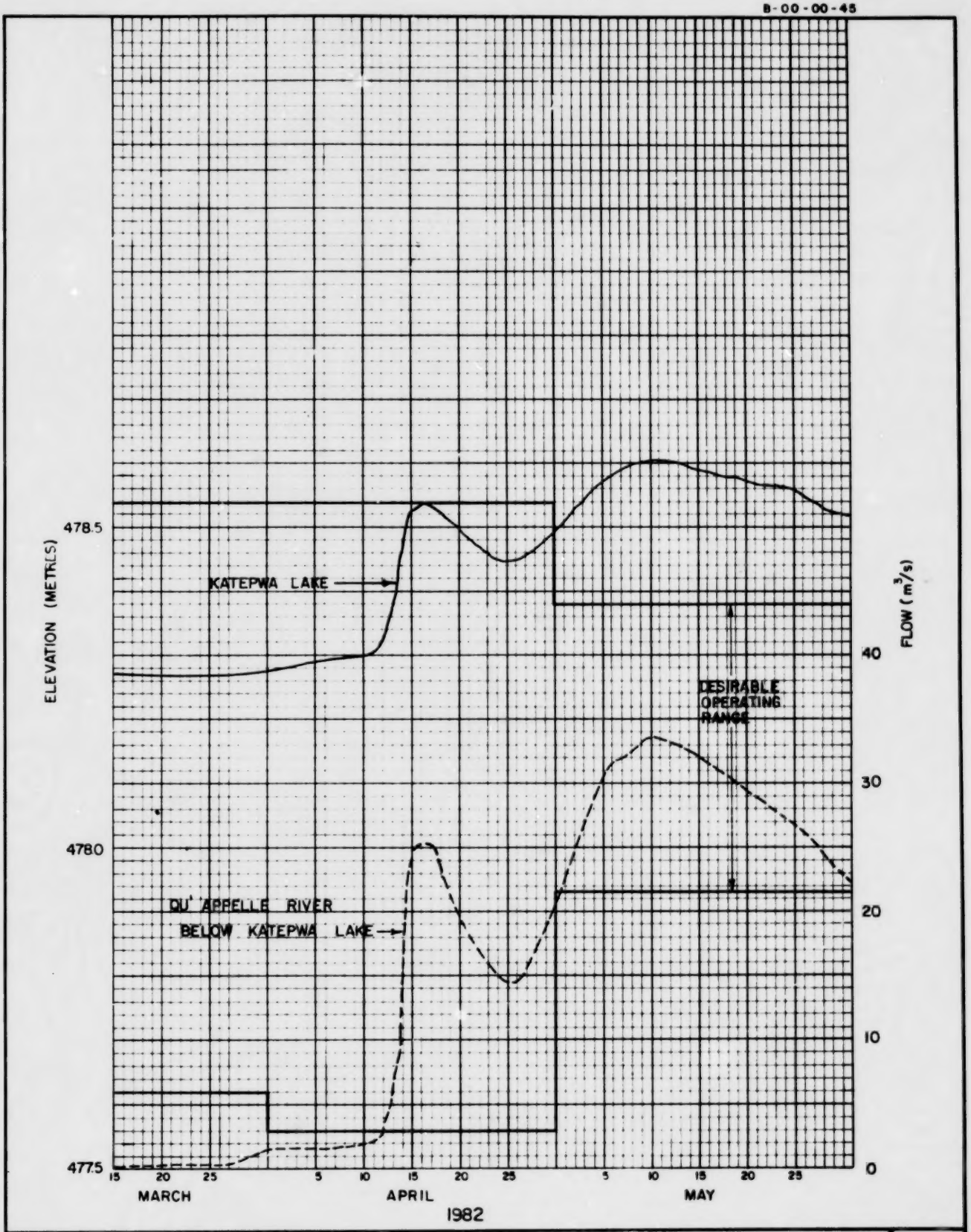
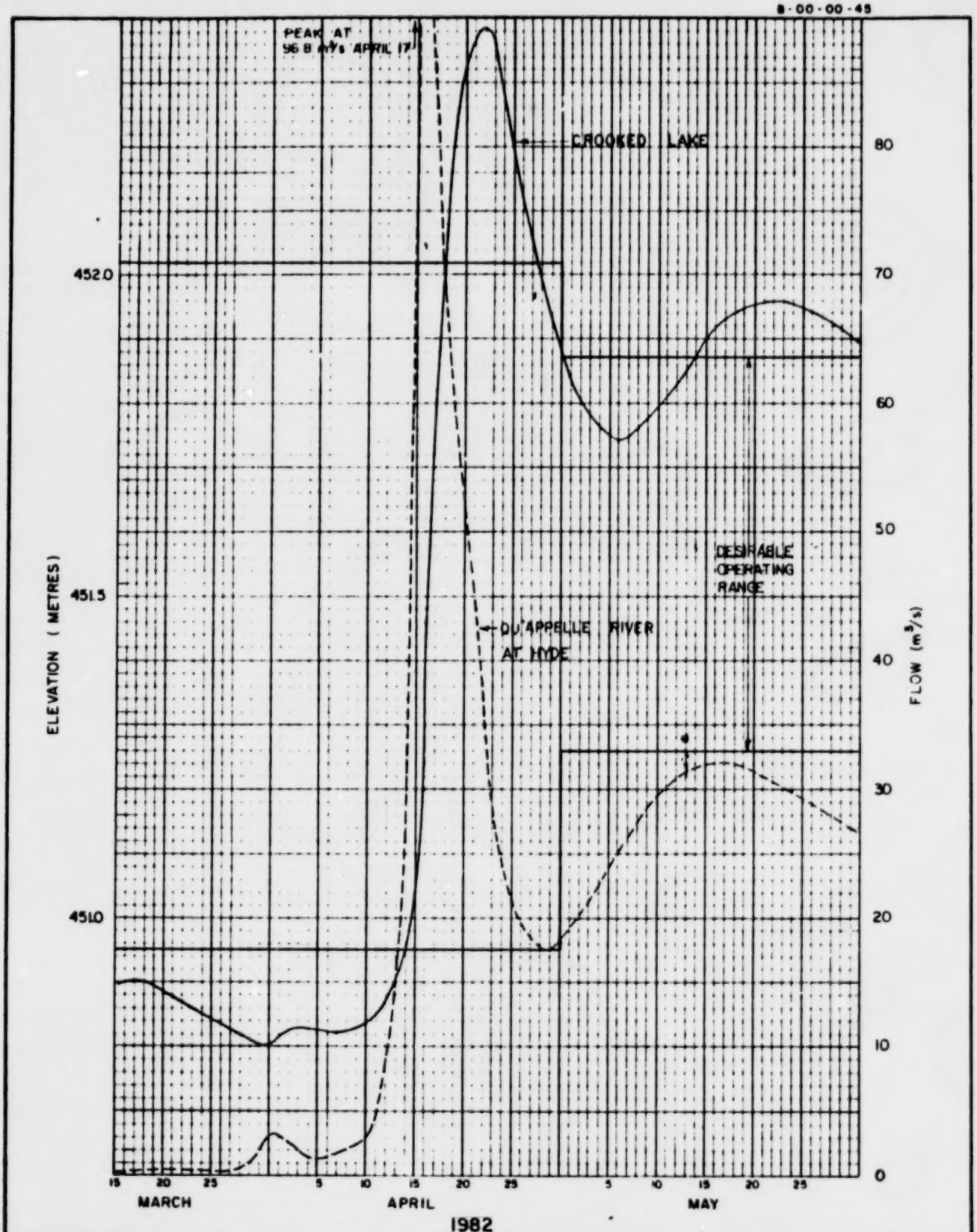
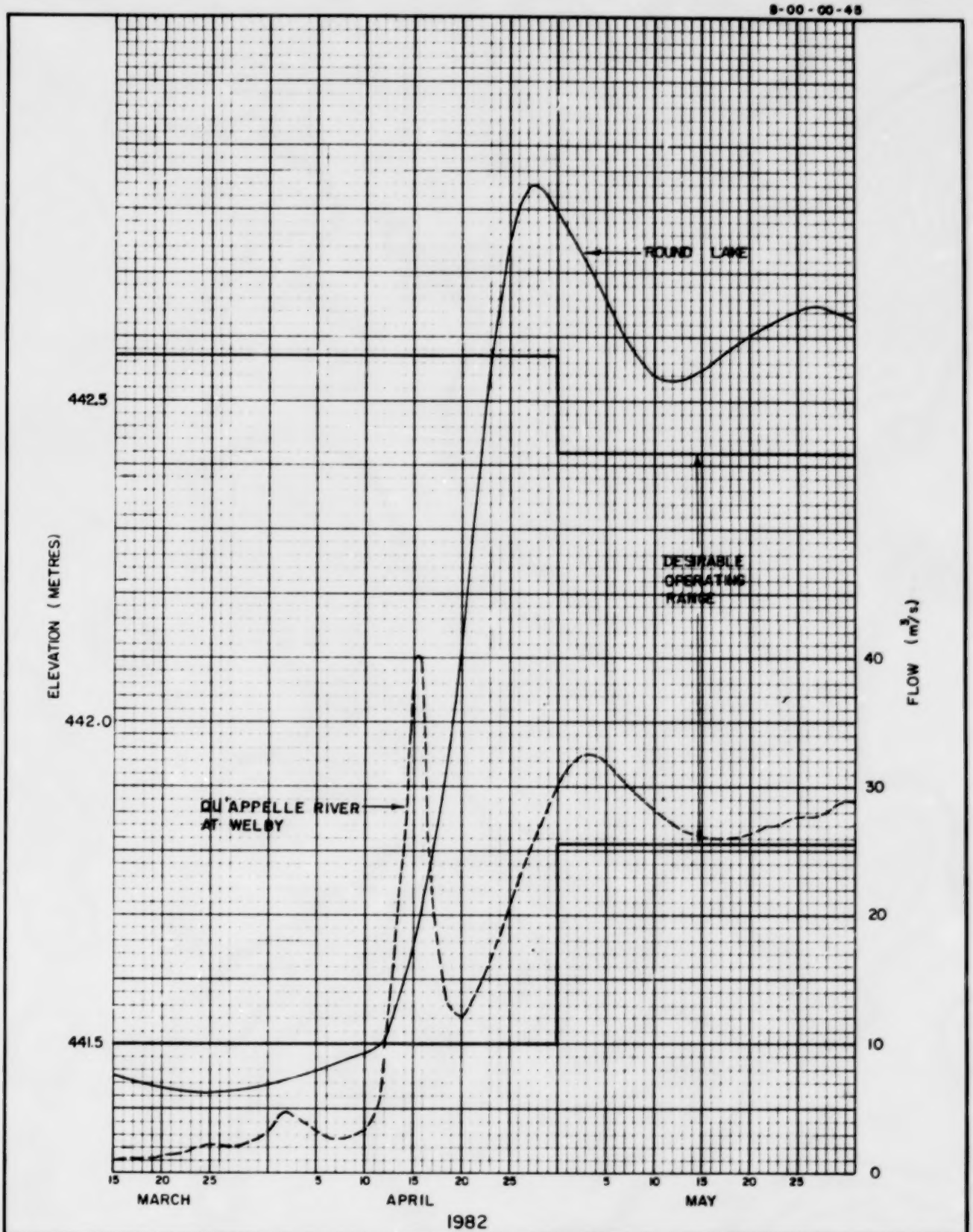


Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN-1982 SPRING RUNOFF KATEPWA LAKE	Figure 8
Drn. J.B.	Date NOV./82		
Ck'd.	Plan No. H5-1(123)		



Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN - 1982 SPRING RUNOFF CROOKED LAKE	Figure 9
Drn. J.B.	Date NOV./82		
Ck'd	Plan No. H5-1(124)		



Saskatchewan Environment Hydrology Branch		QU'APPELLE RIVER BASIN - 1982 SPRING RUNOFF ROUND LAKE	Figure 10
Drn. J.B.	Date NOV./82		
Ck'd.	Plan No. H5-1(125)		

APPENDIX A

1982 SPRING RUNOFF IN THE MOOSE JAW RIVER BASIN

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Operation Planning Division

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Hydrology Branch
Saskatchewan Environment

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10. MOOSE JAW RIVER NEAR STELCAM TYPICAL FLOOD HYDROGRAPHS

11. MOOSE JAW RIVER ABOVE THUNDER CREEK TYPICAL FLOOD HYDROGRAPHS

12. MOOSE JAW RIVER NEAR BURDICK TYPICAL FLOOD HYDROGRAPHS

A. GENERAL

The 1982 spring runoff in the Moose Jaw River basin was preceded by both above average antecedent precipitation and winter precipitation 1/. The antecedent value for August 1 to October 31 was close to the upper quartile, based on a 30 year period from 1952 - 1981. The winter precipitation index was estimated to be just above the upper quartile value.

Most of the antecedent precipitation, fell in the two months prior to the mid-November freeze up. Approximately one-half fell in the last two weeks of October. This minimized evaporation loss and resulted in above normal soil moisture conditions just prior to freeze-up.

The two main factors contributing to runoff are precipitation and the type of melt; temperatures from the first melt in February to the end of April are included on Figure 1.

Mid-winter melts are common in the basin and can result in a considerable loss of snowpack; particularly in the southwestern to western part of the basin. During the winter of 1981-82 a number of melt-freeze cycles were experienced, however, due to the short duration of melt days and a high

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1/ Precipitation indexes are the averages of Moose Jaw, Caron and Yellow Grass meteorological data.

soil moisture content the previous fall, water losses from the snowpack were minimal. The subsequent rapid rate of warm-up and melt resulted in above average mean-daily peak flows of approximately 154 m^3/s at Burdick on April 19. This was approximately 36 m^3/s, or 31% higher than the best estimate forecasted April 1 by regression equations. See Table 1.

Table 1

1982 SPRING RUNOFF VALUES FOR
MOOSE JAW RIVER NEAR BURDICK

Date	Best Estimate from Forecast Equation		Published Forecast		Recorded (from WCS)	
	Peak[1/]	Volume[2/]	Peak	Volume	Peak	Volume
March 1	60	70	60	70	@ 154	154.7
March 15	91	111	80	100		
April 1	118	137.5	110	130		

1/ Mean daily Peak Flow in m^3/s.
2/ March to May volume in $m^3 \times 10^6$.

Considering to the rapid melt and rapidly rising flows on Avonlea Creek near Avonlea, predictions of 200 m^3/s at Burdick, similar to the 1969 peak magnitude of 213 m^3/s, were being made during the progress of runoff. This peak flow at Burdick, however, did not materialize and was approximately 72% of the 1969 peaks. A comparison of the 1981-82 and 1969 snow survey results indicates that there was approximately 65% of the water in the snowpack compared to the water in the

snowpack in 1969 prior to runoff. The comparison of the two years takes into account precipitation falling following the date of the last surveys. Total winter precipitation for this year calculated from meteorological data was 105% of the 1969 winter precipitation.

B. STREAMFLOWS IN THE BASIN

Hydrographs for the stations used by SDOE to monitor or forecast flows for spring runoff are shown on Figures 3 to 12. The hydrographs are plotted from flow information determined and published by both Water Survey of Canada and the Hydrology Branch of Saskatchewan Environment. The hydrographs serve the purpose of comparing the peaks to other high runoff years. The sharpness of the hydrographs are an indication of the rapid rate of warm-up. Figure 2 shows the basin and locations of these stations and the reference numbers are given below.

Station Name and Location	Station Reference Number
Thunder Creek at 9th Avenue N W	23 - 301
Thunder Creek near Boharm	23 - 185
Briercrest Creek near Briercrest	23 - 317
Avonlea Creek near Rouleau	23 - 28
Avonlea Reservoir near Avonlea	23 - 62
Moose Jaw River near Lang	23 - 29
Moose Jaw River near Rouleau	23 - 27
Moose Jaw River near Stelcam	23 - 121
Moose Jaw River above Thunder Creek	23 - 25
Moose Jaw River near Burdick	23 - 21

1. Thunder and Briercrest Creeks

Field observations during the mid-March snow surveys indicated that approximately half of the drainage runs, draws and coulees between Briercrest and Avonlea had experienced flows resulting from a melt that occurred during the second week of March. In mid-March snow cover in this part of the basin ranged from 50 to 90 per cent; a light snowfall just two days before the snow surveys made it difficult to estimate snowcover. Briercrest Creek Creek was estimated to be flowing at 0.2 m^3/s on March 16.

The least snow cover found during the snow surveys, was in the Boharm and Caronport areas. The snow cover was estimated to be 30 to 40 per cent.

On March 15 Thunder Creek in Moose Jaw at 9th Avenue and near Boharm was running at an estimated 0.3 to 0.4 m^3/s. Flow at both stations started in the afternoon of March 14th. The cold weather from March 16 to 21 formed an ice cover on the creeks but the temperature during the last week of March intermittently rose above freezing which helped to keep the water flowing in the channels. Flows from Briercrest Creek were estimated to have reached the main stem around March 31 to April 1. This resulted in a small peak estimated to be 4.5 m^3/s at

Moose Jaw River above Thunder Creek between April 2 and 3 in spite of the cold weather and approximately 0.1 metres of ice cover on the creeks. Thunder Creek at Moose Jaw was first metered at 0.4 m^3/s on March 31. Both creeks likely continued flowing, depleting what had entered the channels until the final phase of spring melt began around April 8-9.

The relatively low peak on Thunder Creek near Boharm was indicative of the lower snowpack in that area of the basin. The water contents represented by the Caronport and Boharm snow courses in 1982 were 46% and 78% respectively, of the basin average.

Hydrographs for Briercrest Creek and the two stations on Thunder Creek are shown on Figures 3, 4 and 5.

2. Avonlea Creek

The abnormally high snowpack, above Avonlea Reservoir, relative to the rest of the basin (140 per cent of Moose Jaw basin average) coupled with a rapid rate of warm-up caused Avonlea Reservoir to spill and increase flows on the Moose Jaw River. Even though the 1982 snowpack, above Avonlea Reservoir, was only 67 per cent (Table 2) of the 1974 snowpack, the 1982 peak elevation and outflow of Avonlea Reservoir actually exceeded 1974 values (Figures 6 and 7).

The Conservation and Development Branch, Saskatchewan Agriculture, confirmed that ice jams did not contribute to these high flow values. In considering storage capacity before runoff it was found that the elevation of the reservoir on October 31, 1981, was within one centimetre of the reservoir elevation of October 31, 1973.

Table 2

SNOW SURVEY COMPARISON UPSTREAM OF AVONLEA RESERVOIR

Course	Year	Date of last snow survey	Snow Survey W.E. (mm)	Total WE (includes ppt after snow survey) 1/ mm	1982 WE (% of 1974)	1982 WE (% of basin 2/ average) mm
Dummer East	1974	April 1	135	145	$\frac{97}{145}$ = 66%	
	1982	March 16	80	97		$\frac{97}{65}$ =149%
Dummer West	1974	April 1	119	129	$\frac{88}{129}$ = 68%	
	1982	March 16	71	88		$\frac{88}{65}$ =135%

Note: 1/ Precipitation between date of last snow survey and date of peak on Avonlea Reservoir included from meteorological stations. 1974 based on 4 stations; 1982 based on Moose Jaw station.

2/ Average Moose Jaw basin water equivalent based on last snow survey done plus precipitation added up to the peak date on Avonlea Reservoir.

Figure 1 shows the mean temperature prior to the peaks on Avonlea Reservoir which occurred on April 15 both in 1974 and 1982. In spite of less snow in the area this year, the much greater rate of warm-up resulted in higher peaks. The hydrograph on Figure 6 indicates a high peak but relatively low volume. In 1974 both a high peak and high volume were experienced.

3. Moose Jaw River

The earliest flows on the main stem upstream of Moose Jaw resulted from inflows from Briercrest Creek. As mentioned previously, the Briercrest Creek flows reached the main stem in the March 31 - April 1 period. This resulted in a peak of approximately 4.5 m^3/s on the Moose Jaw River above Thunder Creek during April 2-3.

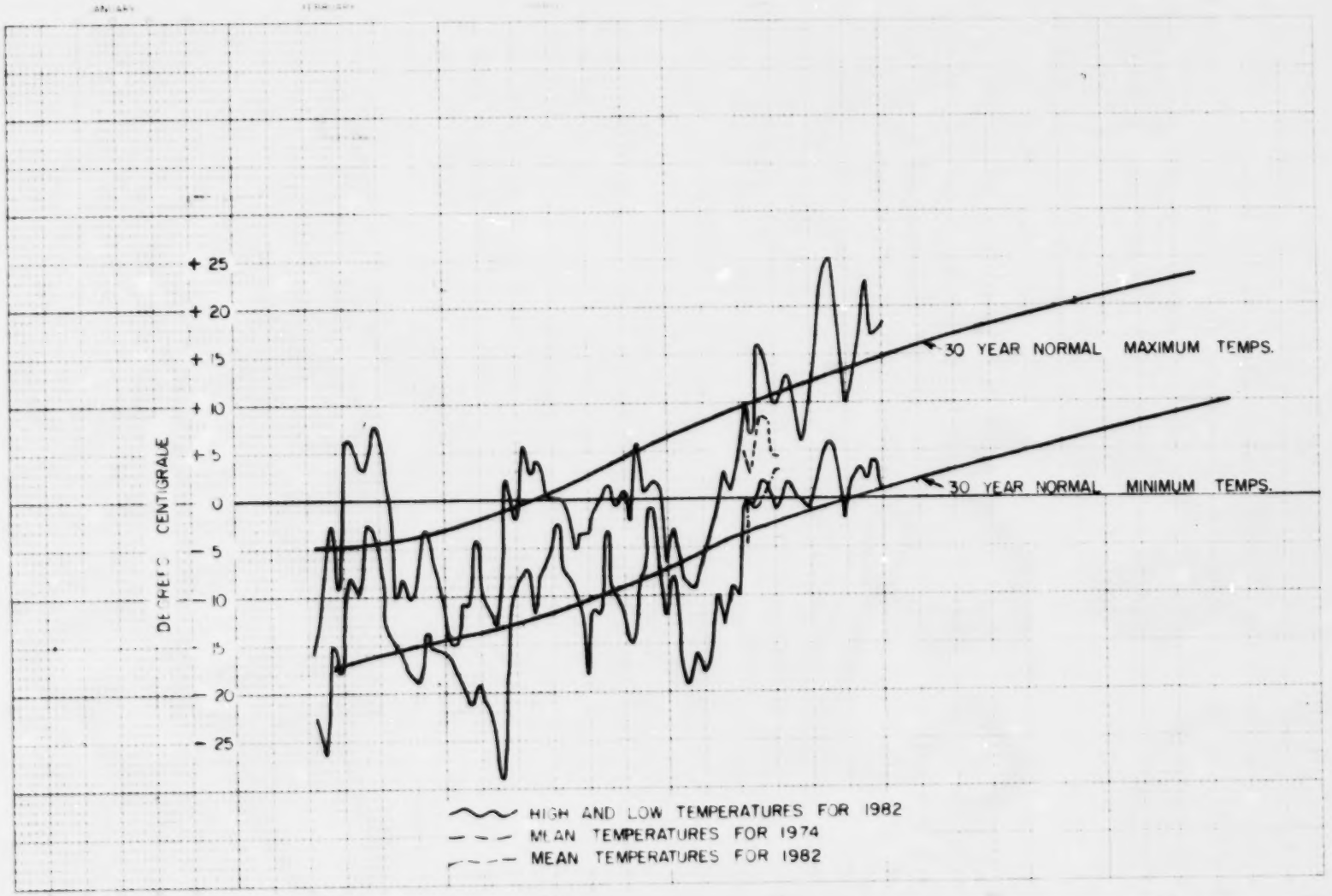
Flows from Thunder Creek arrived at Burdick during the third week of March. These flows from Thunder Creek helped to weaken the winter ice for quicker clearing, and created maximum channel capacity for the mainstem flows from upstream.

The hydrographs on Figures 8 to 12 show the characteristics of the peaks from the above average melt and the comparison to other years.

The mean daily peak flows for the stations on the main stem are as follows:

Moose Jaw River near Lang	22.2 m^3/s
Moose Jaw River near Rouleau	105 m^3/s
Moose Jaw River near Stelcam	149 m^3/s
Moose Jaw River above Thunder Creek	130 m^3/s
Moose Jaw River near Burdick	154 m^3/s

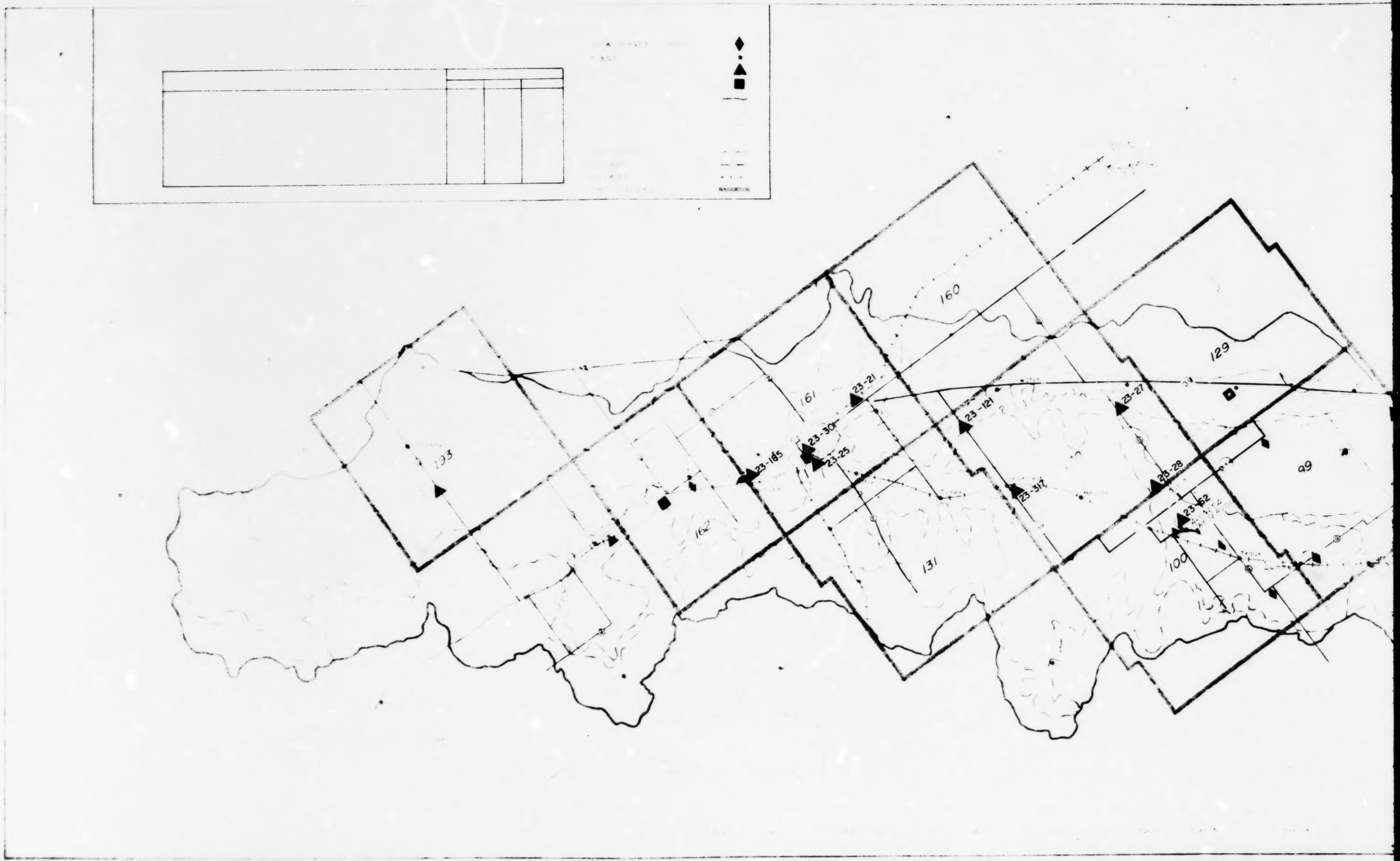
FIGURES



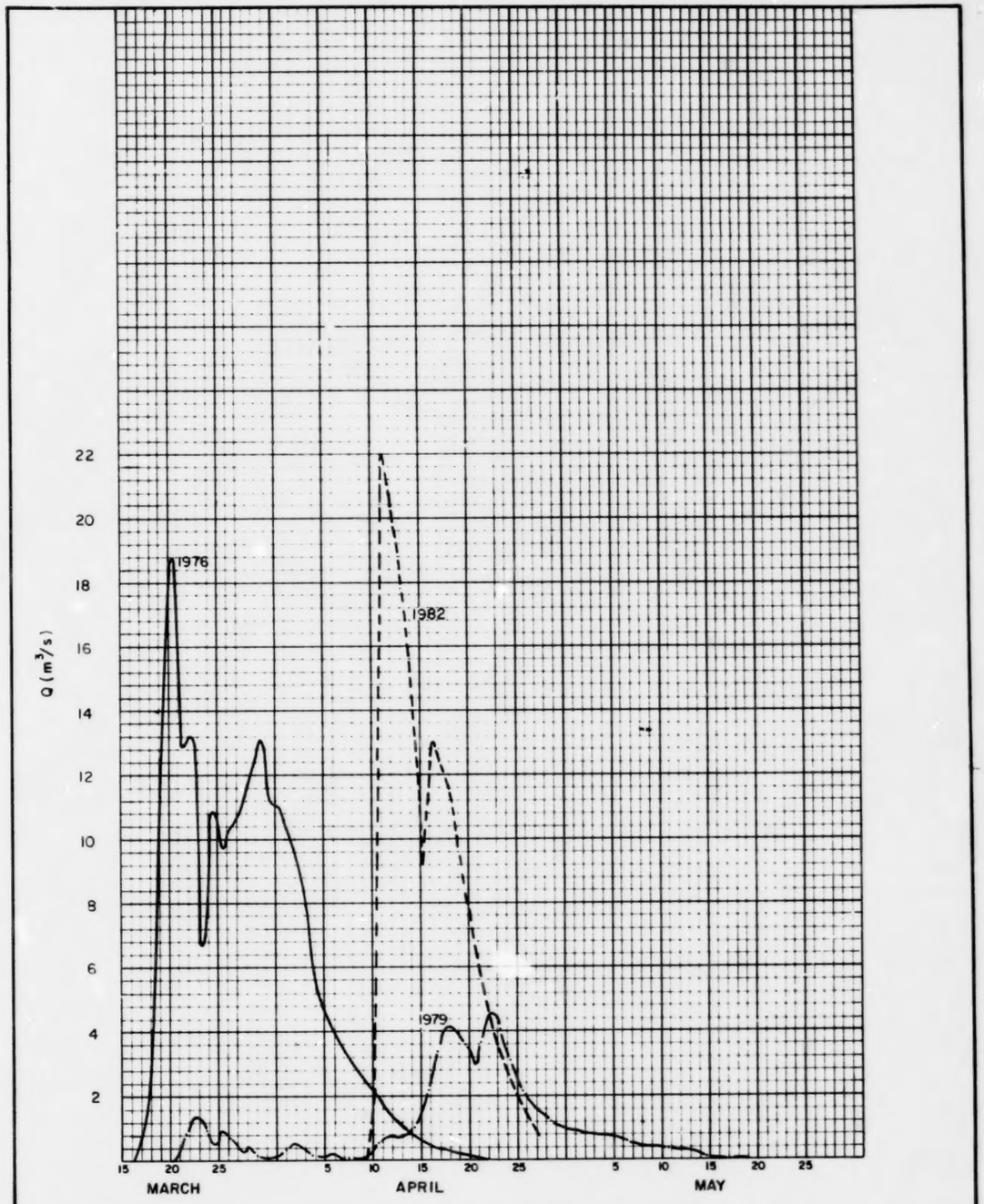
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF	FIGURE
Drn. J.B.	Date JULY/82	CITY OF MOOSE JAW TEMPERATURES	1
Ck'd.	Plan No. H5-3(116)		

47 2533

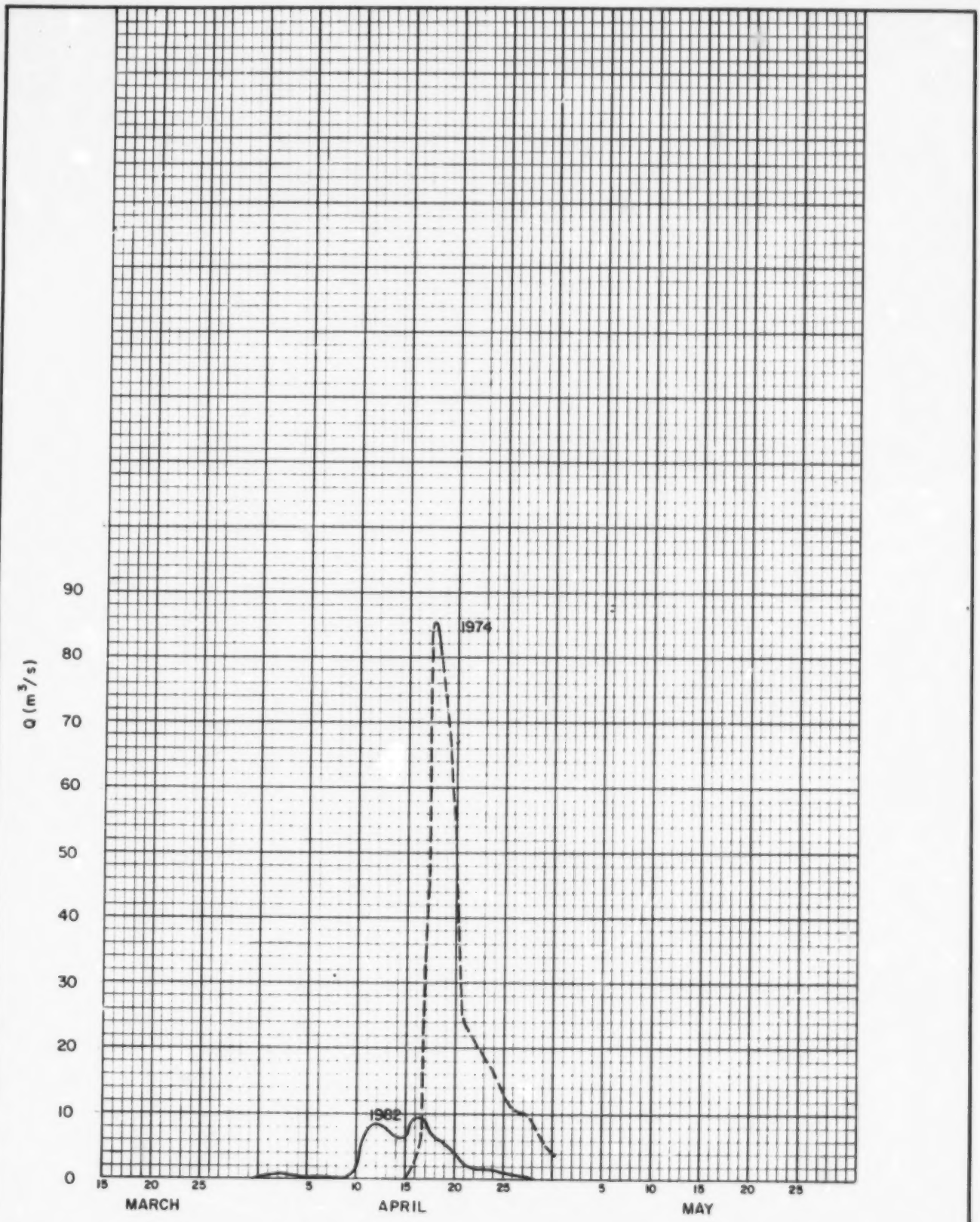
8-07-82-26


160
129
161
23-21
23-27
23-121
23-30
23-25
23-185
23-317
23-28
23-62
133
162
131
100
49

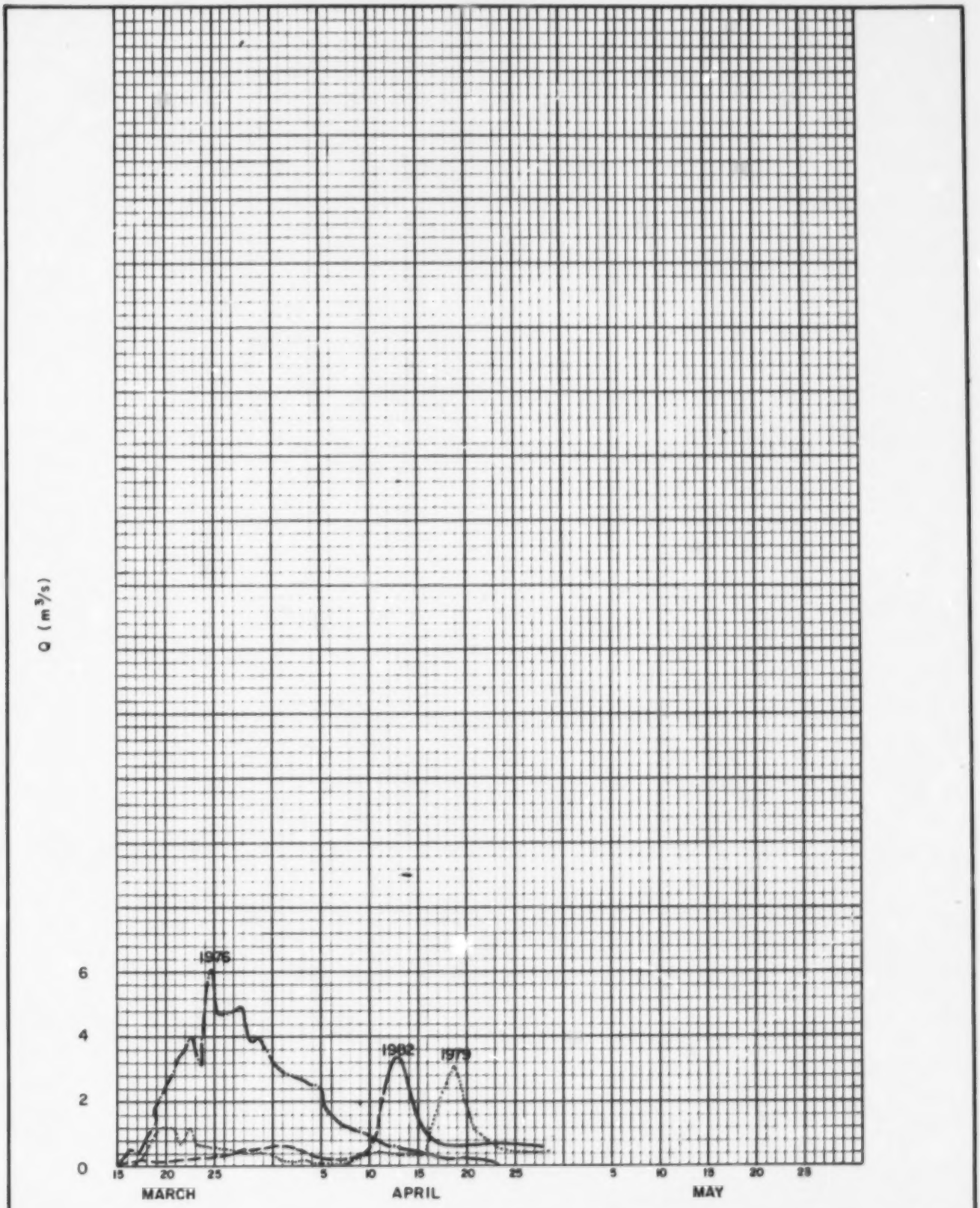
Saskatchewan Environment Hydrology Branch	
MOOSE JAW RIVER BASIN – 1982 SPRING RUNOFF MOOSE JAW RIVER BASIN SHOWING DETAILS FOR MONITORING SPRING RUNOFF	
Drn. J.B.	H5-3(115)
Ck'd.	JULY/82
	2



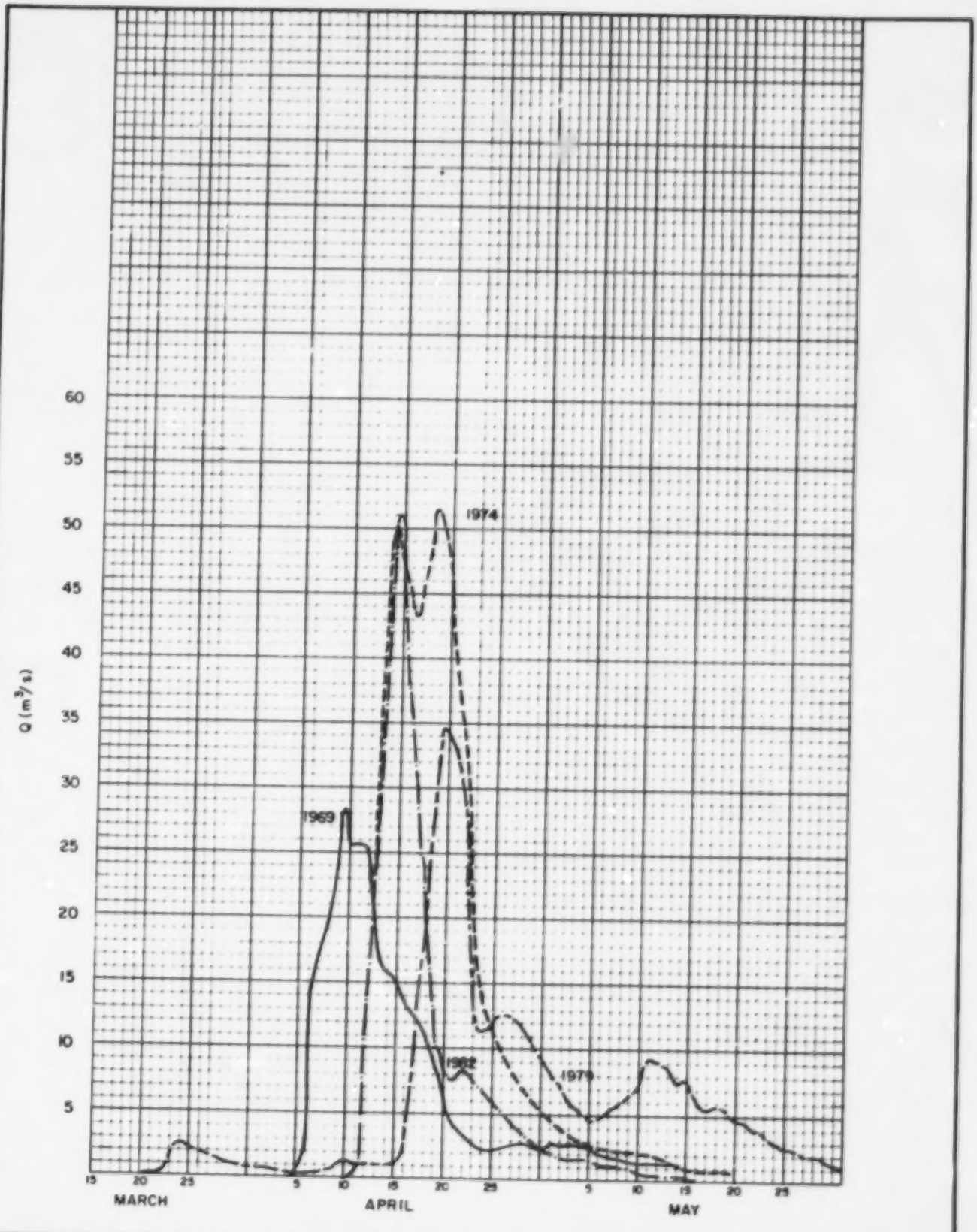
Saskatchewan Environment Hydrology Branch	MOOSE JAW RIVER BASIN – 1982 SPRING RUNOFF THUNDER CREEK AT 9th AVE. NW RUNOFF HYDROGRAPH	Figure 3
Drn. J.B.	Date JULY/82	
Ck'd.	Plan No. H5-3(117)	



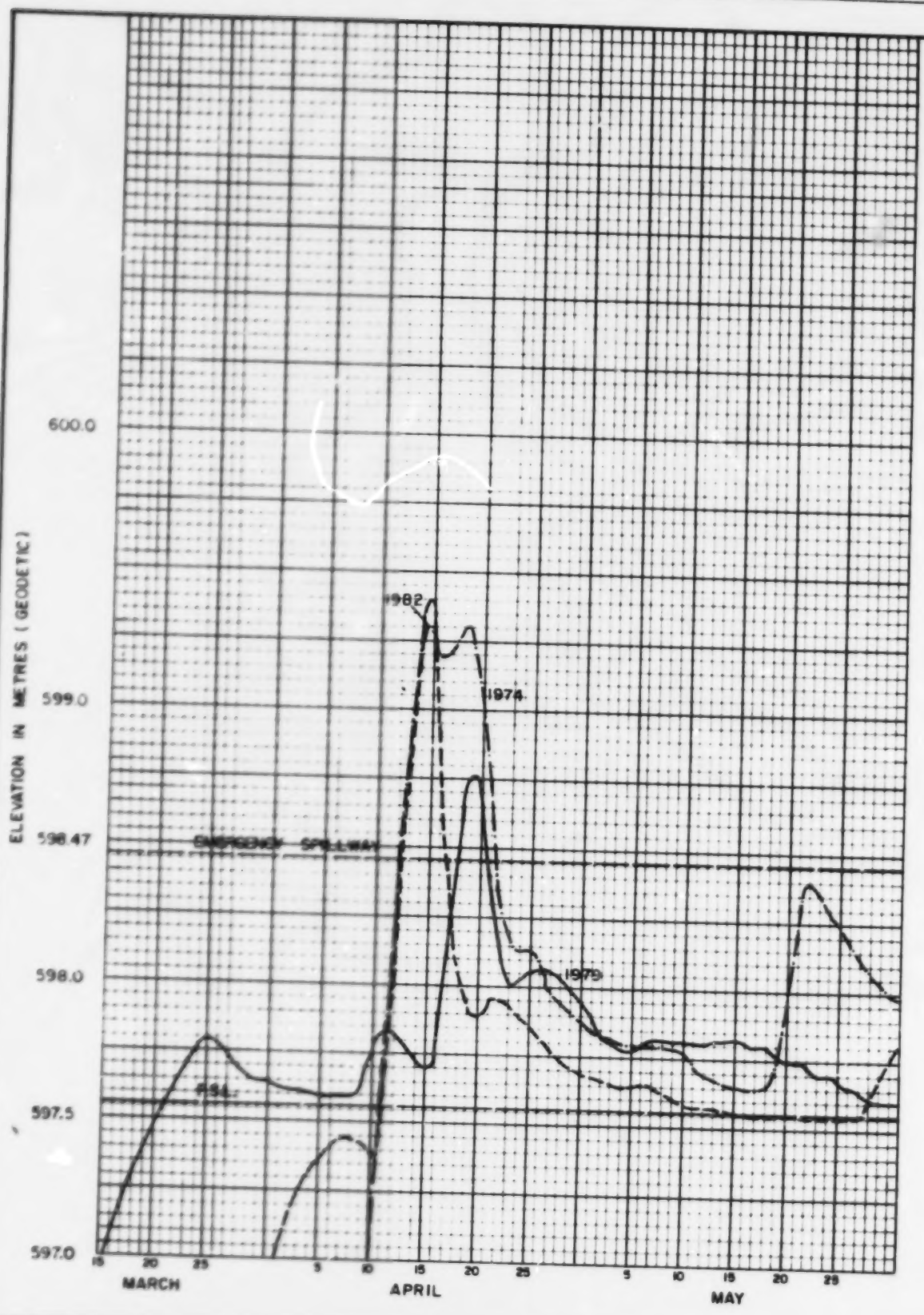
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF THUNDER CREEK NEAR BOHARM RUNOFF HYDROGRAPH	Figure 4
Drn.	Date		
Ck'd.	Plan No. H5-3(118)		



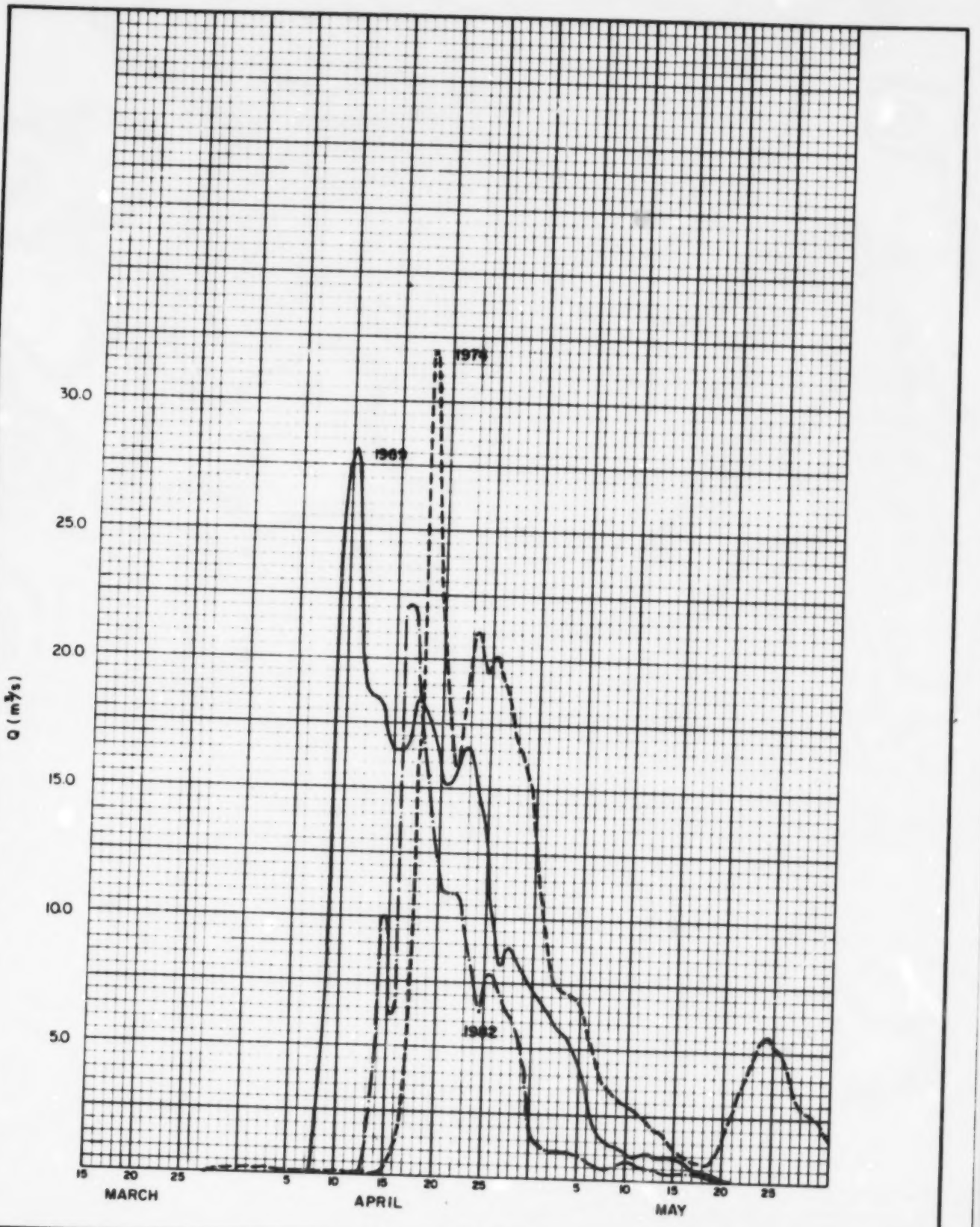
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF BRIERCREST CREEK NEAR BRIERCREST RUNOFF HYDROGRAPH	Figure 5
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(119)		



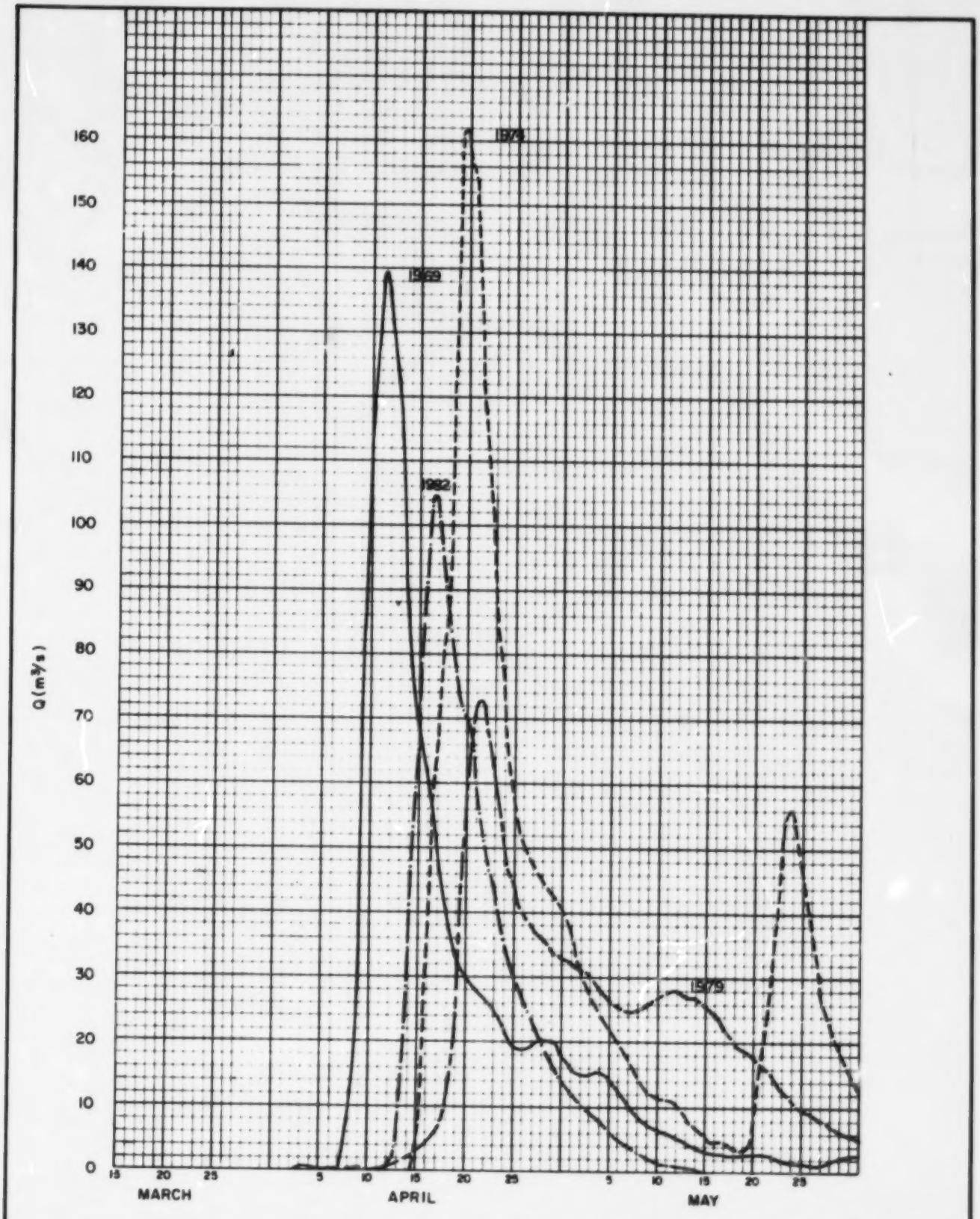
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN – 1982 SPRING RUNOFF AVONLEA CREEK NEAR ROULEAU TYPICAL FLOOD HYDROGRAPHS	Figure 6
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(120)		



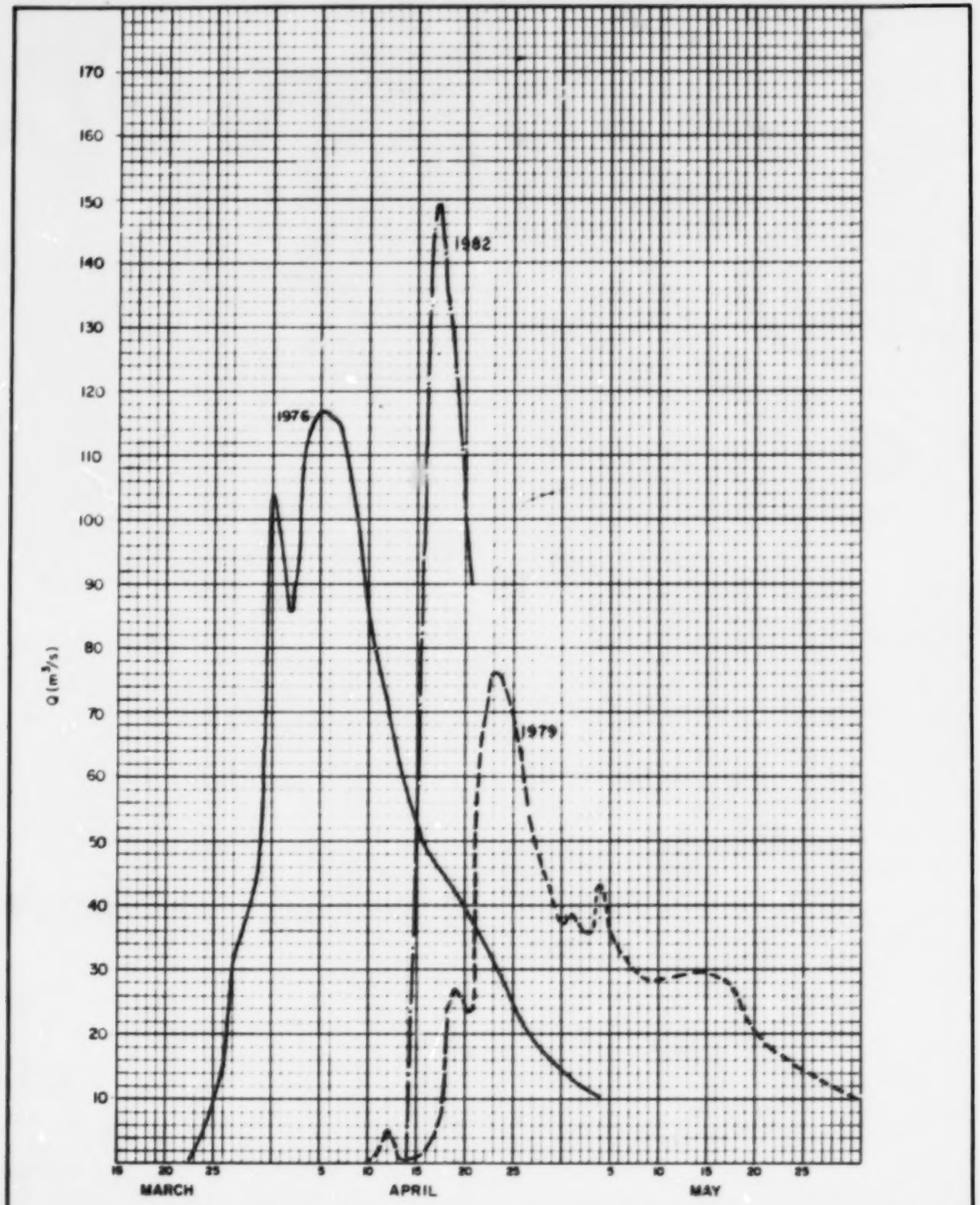
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN – 1982 SPRING RUNOFF AVONLEA RESERVOIR WATER LEVELS	Figure 7
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(121)		



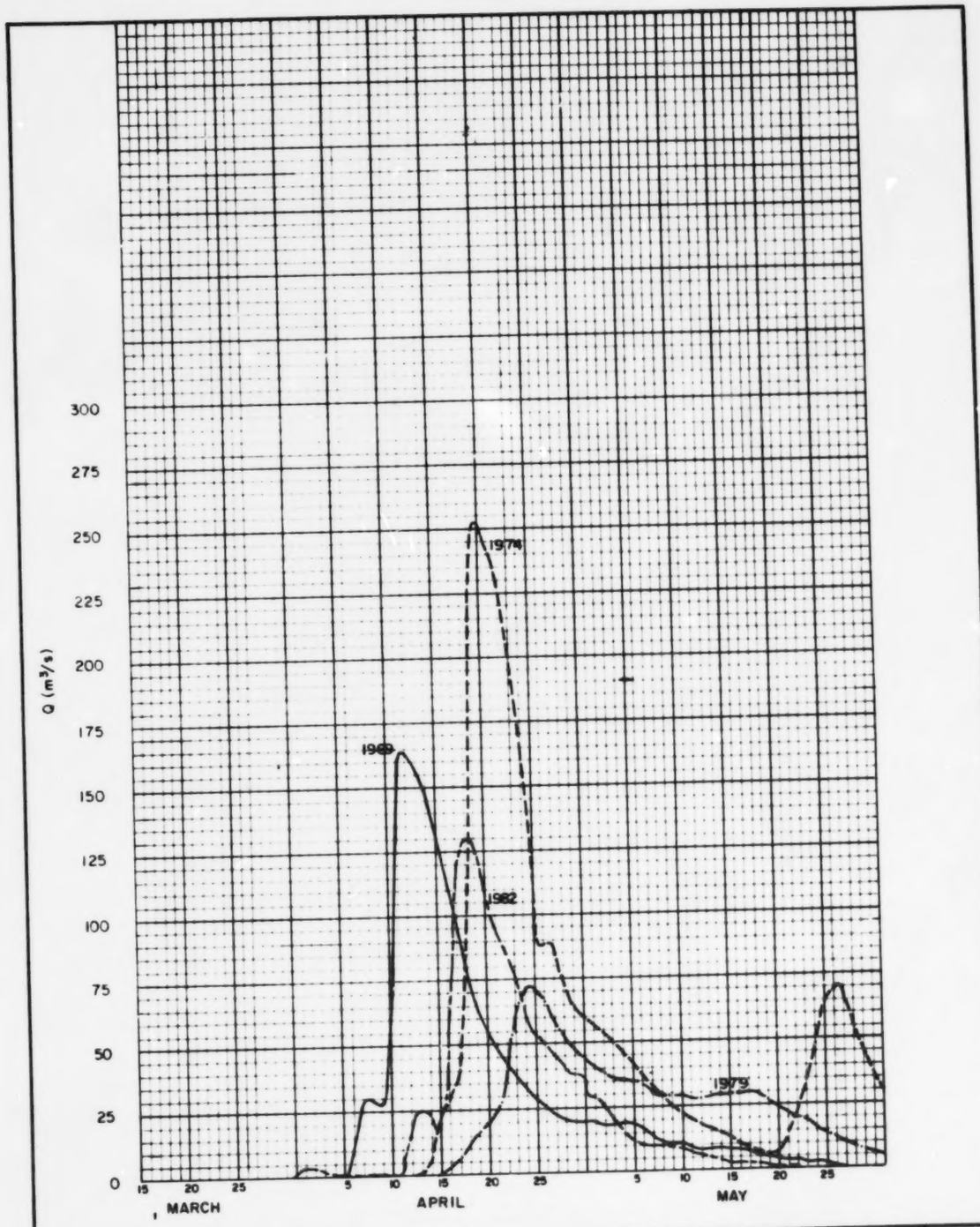
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF MOOSE JAW RIVER NEAR LANG TYPICAL FLOOD HYDROGRAPHS	Figure 8
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(122)		



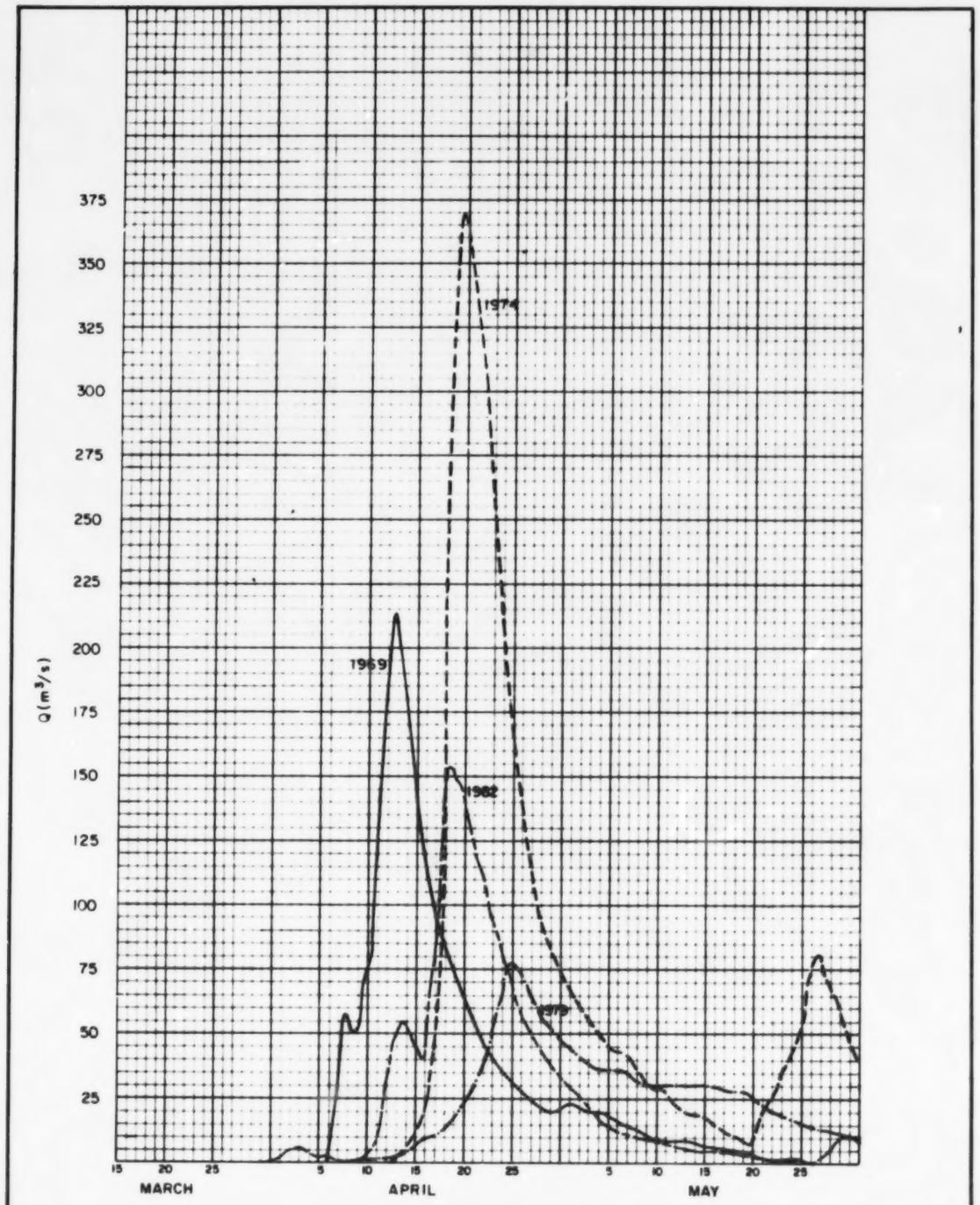
Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF MOOSE JAW RIVER NEAR ROULEAU TYPICAL FLOOD HYDROGRAPHS	Figure 9
Drn. J.B	Date JULY/82		
Ck'd.	Plan No. H5-3(123)		



Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF MOOSE JAW RIVER NEAR STELCAM TYPICAL FLOOD HYDROGRAPHS	Figure 10
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(124)		



Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF MOOSE JAW RIVER ABOVE THUNDER CREEK TYPICAL FLOOD HYDROGRAPHS	Figure 11
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(125)		



Saskatchewan Environment Hydrology Branch		MOOSE JAW RIVER BASIN - 1982 SPRING RUNOFF MOOSE JAW RIVER NEAR BURDICK TYPICAL FLOOD HYDROGRAPHS	Figure 12
Drn. J.B.	Date JULY/82		
Ck'd.	Plan No. H5-3(126)		

APPENDIX B

1982 SPRING RUNOFF IN THE WASCANA CREEK BASIN

Prepared by:

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Operation Planning Division

N. Wyngarrden
Investigation Division

Hydrology Branch
Saskatchewan Environment

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7. WASCANA CREEK NEAR LUMSDEN

A. GENERAL CONDITIONS PRIOR TO AND DURING SPRING RUNOFF

The runoff potential for the Wascana Creek Basin was described as above normal in the March 1, 15, and April 1, 1982, forecasts. Results of these forecasts along with published forecasts are shown in Table 1.

During the period August to October, 1981, the basin received 150 per cent of normal antecedent precipitation. Winter precipitation was approximately 130 per cent of normal; a number of heavy snowfalls were experienced in March with the result that forecasts of peak flows and runoff volumes had to be increased each time a forecast was issued.

The weather during the 1981-82 winter was extremely cold with few warm periods resulting in very little snowpack losses. The weather remained cold and unsettled until mid to late March. During the last week of March and the first of April, daytime temperatures were above freezing but evening temperatures dropped well below freezing, thereby retarding any runoff progress.

As of April 6, there was 100 per cent snow cover in the basin. The only runoff occurring was urban runoff in Regina. Due to the unsettled weather in the first half of the month snowmelt in the headwater was not apparent until approximately April 12-13. Flow

was first observed in the upper reaches of the basin on April 14. At this time, the snow cover in the area around White City to Davin varied from 25 to 50 per cent. All areas to the east and south had 100 per cent coverage.

An unusually high amount of drifting in the basin resulted in all the creeks and most of the bridges being plugged with snow. As the water proceeded downstream, it had to open up the creek and push its way through the bridges openings resulting in some backwater and minor flooding at numerous points throughout the basin. The tributaries, namely, Pilot Butte Creek, Chuka Creek, Hunter Creek, McGill Creek, Fahlman Creek and Manybones Creek began running on about April 14. By April 17, they had all peaked along Highway 33.

Runoff on the mainstem Wascana Creek started near Sedley on April 15, but due to the same snow blockage problems as experienced on the tributaries, flows did not reach Kronau Marsh until April 17. The blocked bridges caused backwater, resulting in some minor flooding and washouts along some rural roads. Peak flows passed through Regina on April 21 without any major problems.

Downstream of Regina to the junction with the Qu'Appelle River, some flooding occurred due to ice jams. An initial peak of 99.9 m^3/s was recorded at the hydrometric station "Wascana Creek near Lumsden" on April 19. This peak appears to have been caused by ice

jams upstream of the junction of Cottonwood Creek. A second peak of 94 m^3/s passed by this station on April 23.

Figure 1 shows the Wascana Creek Basin and the location of the hydrometric stations used to forecast and/or monitor the flow for the City of Regina and Wascana Creek at Lumsden. The stations used this year are listed in the following table.

Station Reference Number	Station Name and Location
23-178	Pilot Butte Creek at No. 33 Highway
23-191	Chuka Creek at No. 33 Highway
23-176	Hunter Creek at No. 33 Highway
23-175	McGill Creek at No. 33 Highway
23-174	Fahlman Creek at No. 33 Highway
23-44	Fahlman Creek at Davin
23-177	Manybones Creek at No. 33 Highway
23-19	Wascana Creek near Sedley
23-311	Wascana Creek at Kronau Marsh Inflow
23-190	Wascana Creek at Kronau Marsh Outflow
23-181	Wascana Lake at the Marina
23-169	Wascana Creek at Cameron Street
23-63	Cottonwood Creek near Lumsden
23-17	Wascana Creek near Lumsden

B. DETAILED SUMMARY OF SPRING RUNOFF BY STATION

Hydrographs of spring runoff at most of the main hydrometric stations in the basin are plotted along with typical flood hydrographs and are shown on Figures 2-7, inclusive. The 1982 hydrographs were constructed based data published by Water Survey of Canada and the Hydrology Branch of Saskatchewan Environment.

1. Pilot Butte Creek

Prior to April 14, ponding in Pilot Butte Creek was due to urban runoff from Regina. Up to that point, there had been insufficient melting in the rural areas to get water moving in the channel. During the evening of April 14 and early morning of April 15, flow started down Pilot Butte Creek but progress was halted by a snow blocked bridge at Dewdney Avenue. The water backed up until it flooded over Dewdney Avenue. The water level started to rise at No. 33 Highway on the morning of April 15 and peaked at approximately 13 m^3/s later that afternoon. Flows were well into recession by noon on April 16.

2. Hunter Creek

Flows in the headwaters of Hunter Creek were first noted on the morning of April 14. At this time, there was still 25 per

cent to 50 per cent snow cover in the upper reaches. There had been some ponding at No. 33 Highway beginning April 11, but no flow occurred until April 15 due to all the snow under the highway bridge. Hunter Creek peaked on April 17 at approximately 10.5 m^3/s and was well into recession by April 19.

Chuka Creek, McGill Creek and Manybones Creek followed the same pattern as Hunter Creek. Each of these small tributaries experienced some minor flooding in adjoining fields due to snow blocked channels and bridges. Because of the "flashiness" of the runoff, flows were not metered on these tributaries.

3. Fahlman Creek

Flow at the "Fahlman Creek near Davin" hydrometric station was first recorded April 12 and peaked on April 15 at 2.1 m^3/s as shown on Figure 2. These flows did not pass through No. 33 Highway until April 15 when the snow under the highway bridge had been cleaned out. Backwater caused by the snow blockage at the bridge at No. 33 Highway resulted in some minor flooding of a small area on the edge of Kronau townsite.

4. Wascana Creek

Problems encountered on the mainstem Wascana were much the same as those experienced on the small tributaries in the

basin; a heavy snowpack in the channels and under all the bridges caused some minor inconveniences. These inconveniences consisted mainly of flooded fields, roads and washouts at bridges throughout the basin.

(a) Wascana Creek near Sedley

Figure 3 shows that flows at Sedley did not start until approximately April 15, although water had been ponding at the site for three to four days. Once the flow had started, the peak came fairly rapidly and on April 17, a peak of 47 m^3/s was recorded.

(b) Wascana Creek at Kronau Marsh Outflow

By April 16, the flow had started at the marsh outflow with a peak of approximately 66 m^3/s being recorded on April 19 as shown on Figure 4. No unusual problems were observed at this point.

(c) Wascana Lake at the Marina and Wascana Creek at Cameron Street

On April 1, the elevation of Wascana Lake was 570.328 m. On April 6, in preparation for spring runoff and to allow break-up of the ice in Wascana Creek below Wascana Lake, the gates were opened at Albert Street. Inflow to Wascana Lake started on April 11 and on April 14 all the logs in the structure were removed to allow runoff water

to pass unrestricted. The lake reached a peak elevation of 571.434 m on April 21. The logs were replaced on April 17 and on May 7 the gates were completely closed. On April 17, bank full flows in Wascana Creek along Rotary Park were observed to be approximately 49 m^3/s. Peak flows of approximately 60 m^3/s caused minor flooding in Rotary Park and major erosion of dykes immediately downstream of Albert Street. Some minor flooding also took place in the parkland along Wascana Creek between Elphinstone and Pasqua Streets. Spring hydrographs for Wascana Lake and Wascana Creek below Wascana Lake are shown on Figure 5 and 6 respectively.

(d) Wascana Creek near Lumsden

As shown on Figure 7, spring runoff flows first reached the hydrometric station "Wascana Creek near Lumsden" on April 13, building to a peak flow of 99.9 m^3/s on April 19. A second peak of 94 m^3/s followed four days later on April 23. The initial peak of 99.9 m^3/s is believed to be caused by near peak flows from Cottonwood Creek, flows from the mainstem Wascana and the breaking up of a major ice jam upstream of the station. Abnormally high water levels had been reported at Sherwood Forest Country Club prior to April 19. Some flooding in Sherwood Park and along the Wascana Creek did occur and the hydrometric station "Wascana Creek near Lumsden" was flooded for a number of days.

Table 1

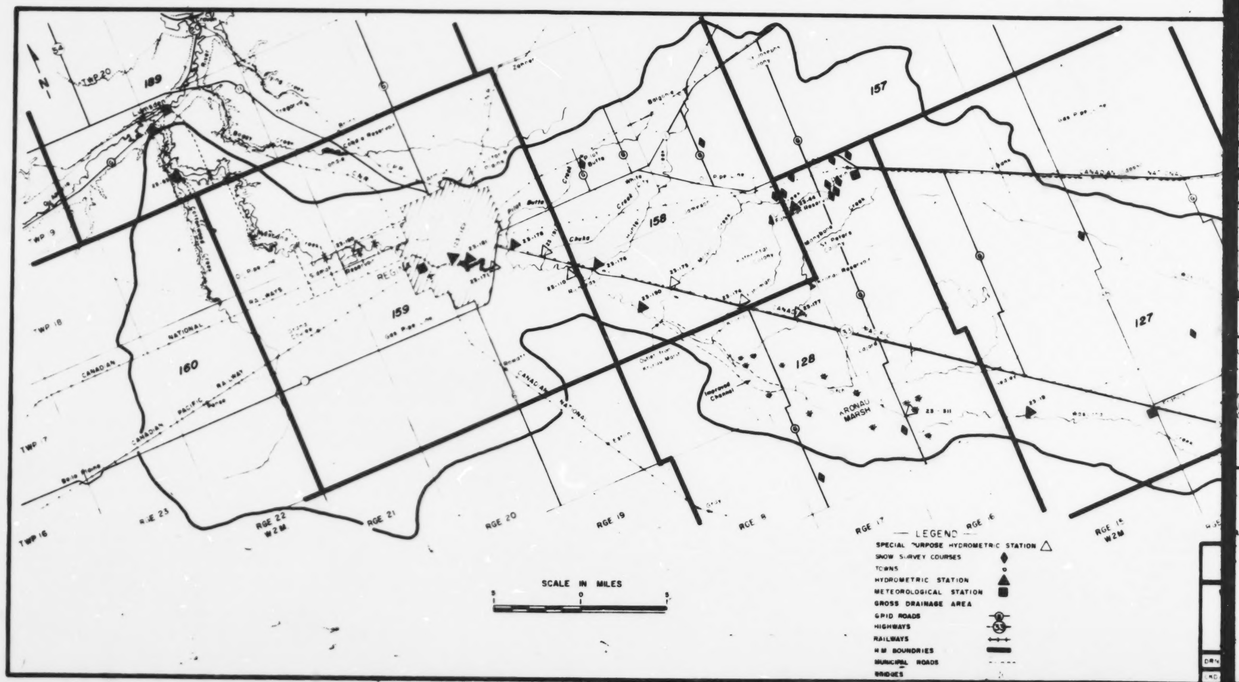
1982 PUBLISHED SPRING RUNOFF FORECAST - WASCANA CREEK

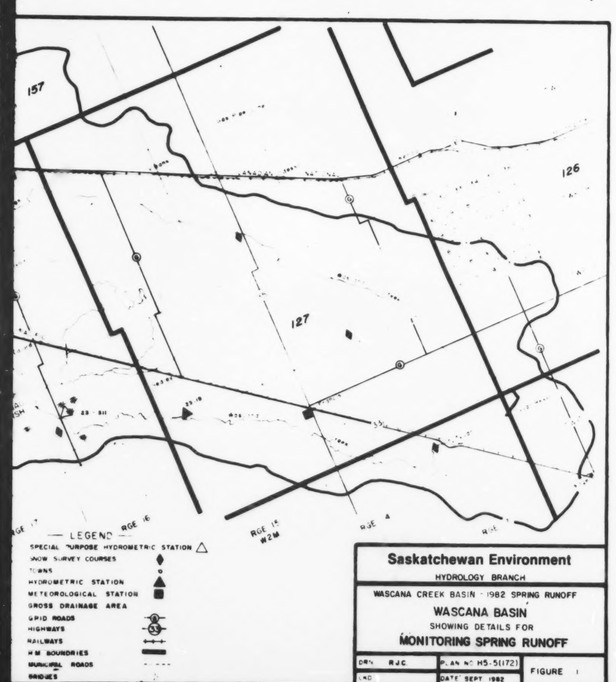
	Forecast Peak Flow in m^3s			Recorded	
	March 1	March 15	April 1	Peak m^3/s	Date
Regina	25	45	55	62.5	April 21
Lumsden	30 *47.3	50 *56.1	60 *66.8	99.9	April 19

	Forecast Volumes x 10^6 m^3			Recorded
	March 1	March 15	April 1	March to May Volume x 10^6 m^3
Regina	30	40	50	66.3
Lumsden	50 *54.7	60 *63.7	70 *74.5	103

* Computed by forecast equations.

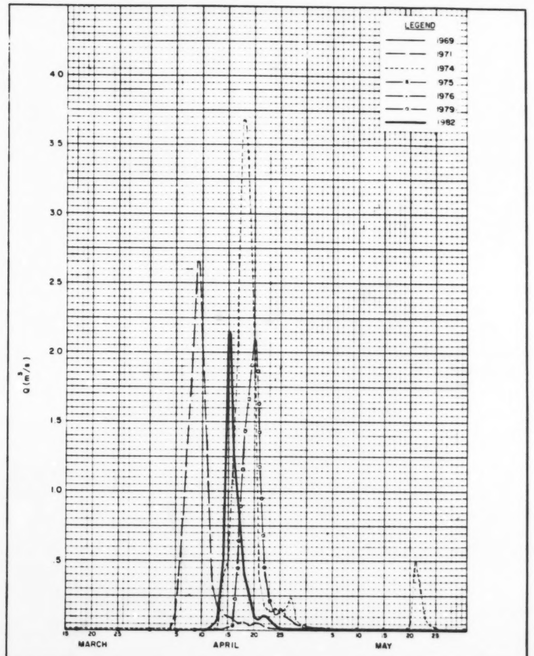
FIGURES



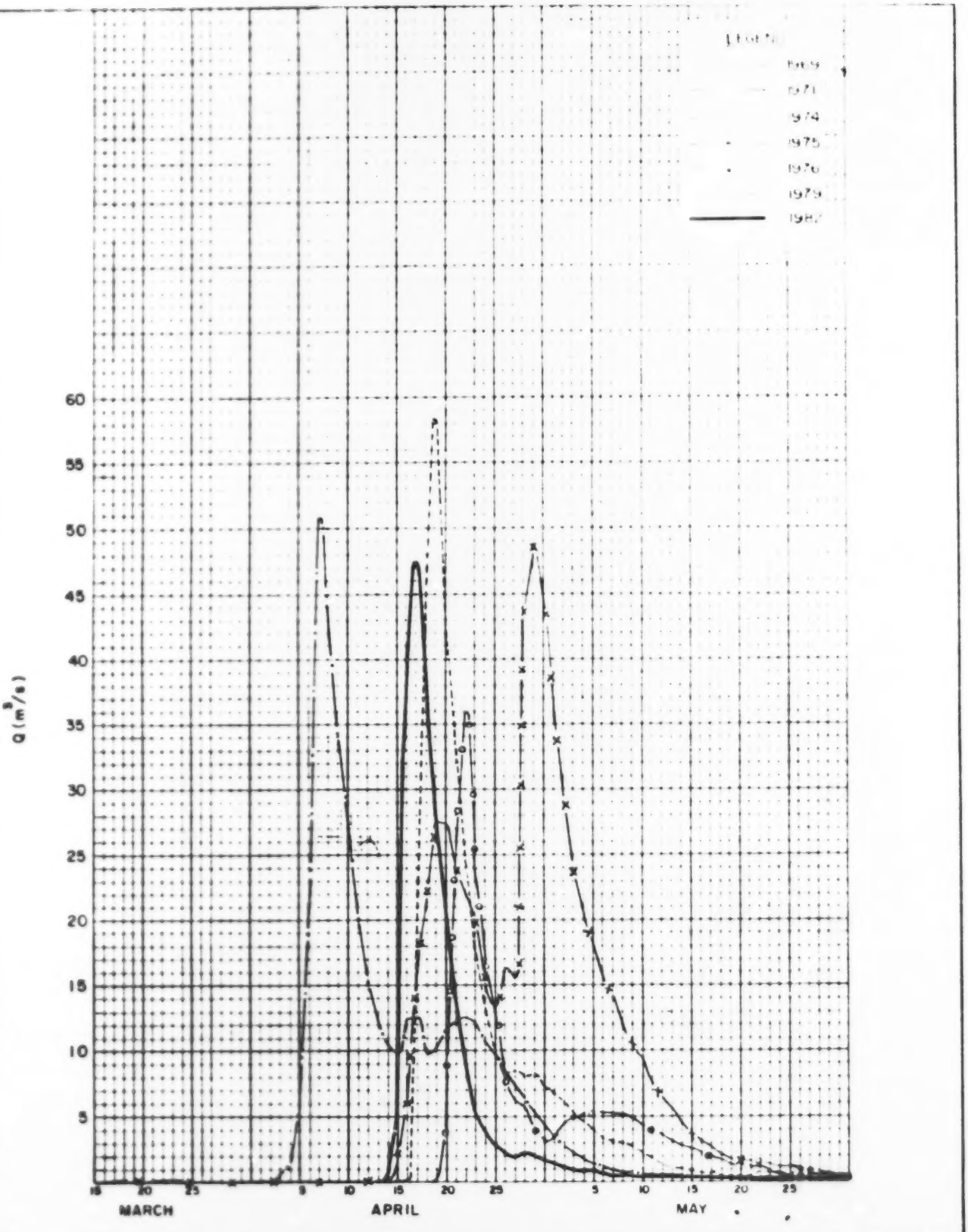


Saskatchewan Environment
HYDROLOGY BRANCH
WASCANA CREEK BASIN - 1982 SPRING RUNOFF
WASCANA BASIN
SHOWING DETAILS FOR
MONITORING SPRING RUNOFF

DRN. RJC	PLAN NO. H5-5(172)	FIGURE 1
CKD.	DATE SEPT 1982	



Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
Drn. C B BOSLEY	Date AUG 1982	FAHLMAN CREEK NEAR DAVIN	2
Ck'd	Plan No. H5-5(17[illegible])		



Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
Drn. C.B. BOSLEY	Date AUG 1982	WASCANA CREEK NEAR SEDLEY	3
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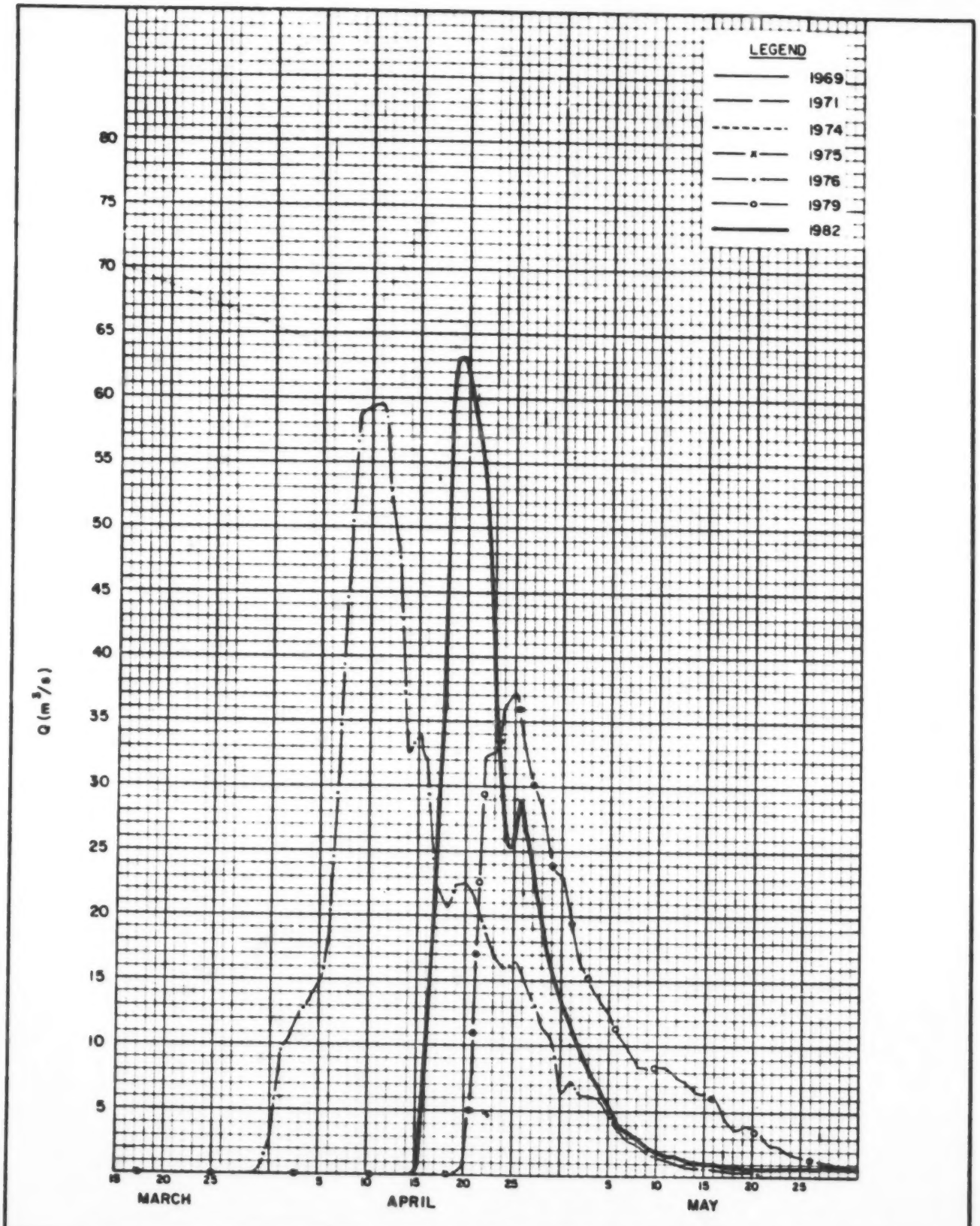
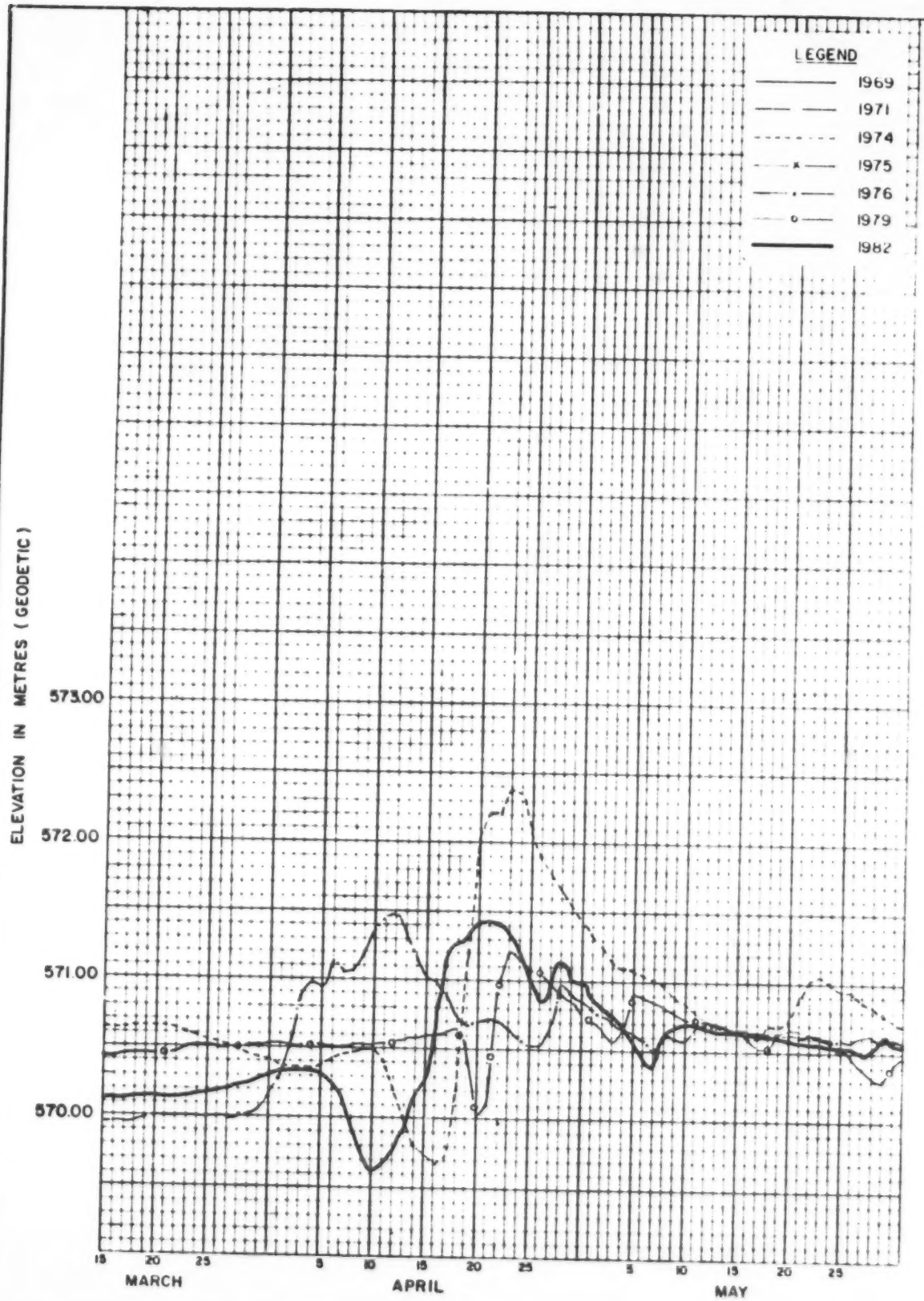


Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
Drn. C.B. BOSLEY	Date AUG 1982	WASCANA CREEK BELOW KRONAU MARSH	4
Ck'd	Plan No. H5-5(175)		



Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
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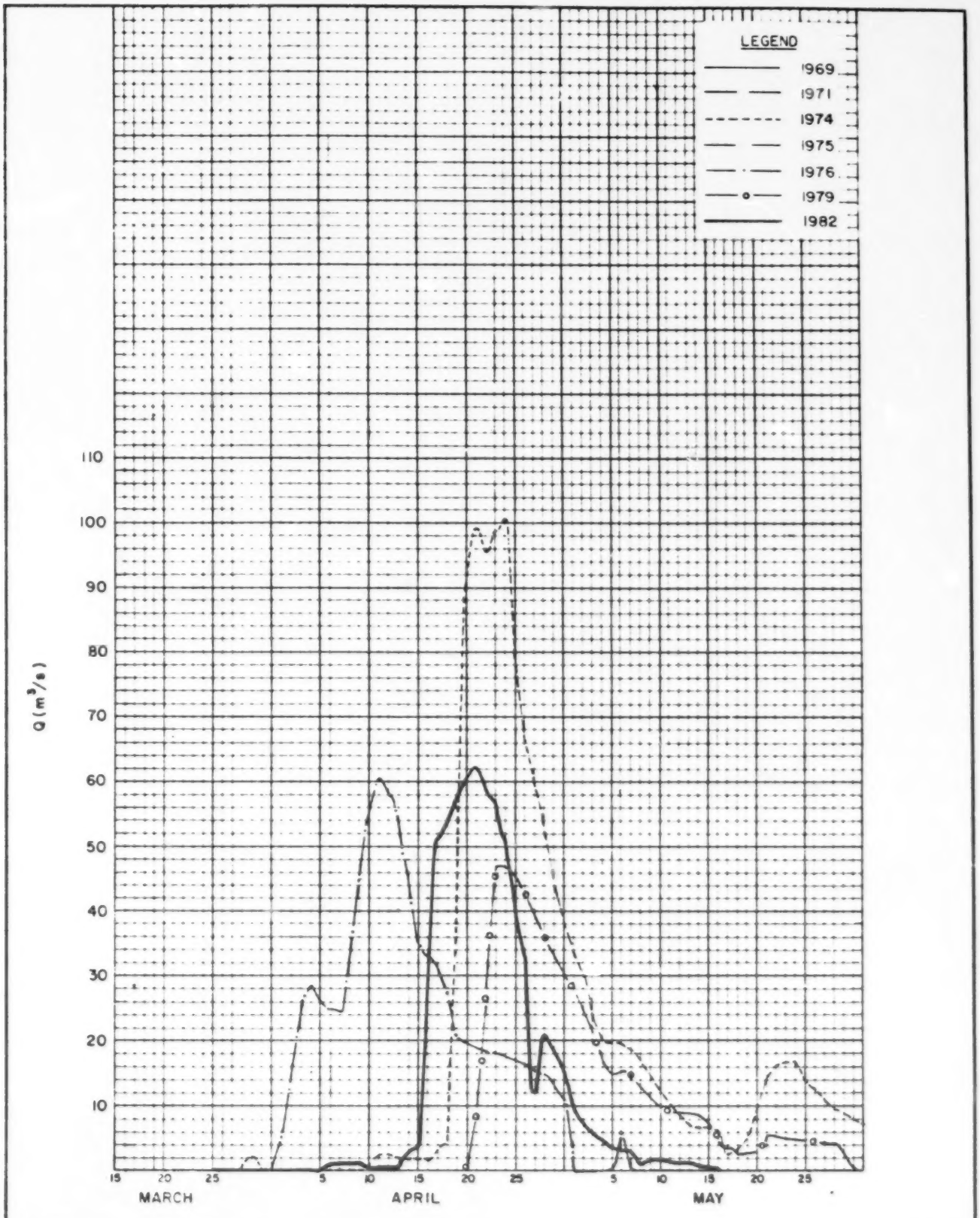

Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
Drn. C B BOSLEY	Date AUG. 1982	WASCANA CREEK AT CAMERON ST.	6
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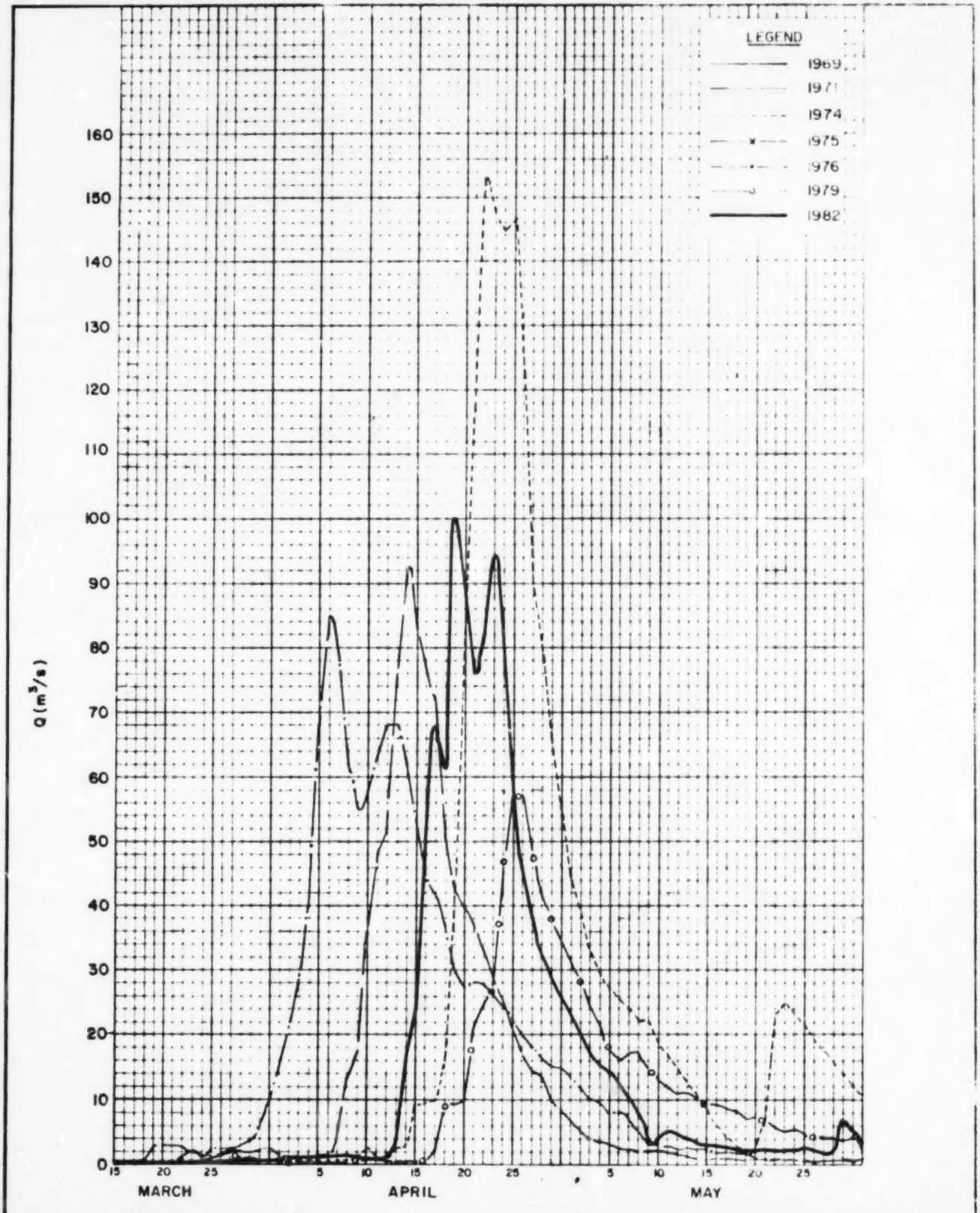

Saskatchewan Environment Hydrology Branch		WASCANA CREEK BASIN - 1982 SPRING RUNOFF	Figure
Drn. C.B.BOSLEY	Date AUG. 1982	WASCANA CREEK NEAR LUMSDEN	7
Ck'd.	Plan No. H5-5(176)		

POOR

QUALITY

ORIGINAL